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Designing technology for domestic spaces:

A Kitchen Manifesto ¹

Jenny Nelson (Doris Day): “Oh boy! This kitchen doesn’t need a woman!”

Bruce Templeton (Rod Taylor): “Jenny, you’re the one good thing in this kitchen I didn’t make provision for.”

*Glass Bottom Boat*²

Glass Bottom Boat is one of those Hollywood movies: ditzy blonde disrupts the orderly life of rational scientist. Bruce Templeton, a NASA physicist played by Rod Taylor, has designed himself the perfect home, equipped with labor-saving devices. His kitchen is a showpiece of streamlined functionality. Cooking becomes just another task, one that can be controlled and contained. The kitchen—automated with appliances popping out of counter tops and self-cleaning dishes and floors—confounds Doris Day’s character and renders her “feminine” skills obsolete; she is compelled to declare that there is no place for her in this kitchen of the future. Her declaration that “this kitchen doesn’t need a woman” captures a central theme of this paper. In creating technology for the home, in particular for the kitchen, technologists have forgotten that these

domestic spaces are inhabited and used by people. These spaces function not as sites for technologists' or technological in(ter)vention, but as sites where meaning is produced, as well as meals. These spaces are the places where we dwell.³

Bruce Templeton's house offers one representation of the twentieth century's preoccupation with automating and optimizing the domestic sphere, but the home of the future has always had a certain seductive appeal to both Hollywood and industry. In this paper, we want to excavate the home of the future, making clear the connections between this vision of the domestic and the discourses of modernity, as well as tracing the futurist home's connections to the "smart house."⁴ Throughout this paper, we attempt to draw a critical distinction between "house" and "home." People inhabit homes; technology powers houses. Rosalind Coward provocatively suggests a similar distinction in her critical essay "Ideal Homes," in which she discusses representations of home improvement in magazines such as the British *Ideal Homes Magazine*:

In spite of the offer of an intimate glimpse into a private home, all traces of life in that home tend in fact to be obliterated. The owners are evicted by the photographic regime. The house is photographed as it probably never is – tidy, sparkling clean, free of persons and their ephemera. These are not *homes* but *houses*. They are the finished products, the end of the long years of planning or 'loving restoration'. These are the houses that exist in the imagination during the years of painting, scrubbing and hammering... To represent a lived-in home would destroy for ever more the illusion that a house could ever be finished and perfect.⁵

Our focus is technology, not interior decorating, but the point that houses of the future exist only in the imagination is a strong one. Here we want to look at the

smart house analytically and historically, to create a context and genealogy within which current and past research can be rendered intelligible.

The trajectory from the early display houses of tomorrow to the current discussion of smart houses is one that ultimately conflates the domestic with the industrial and leaves little room to imagine real lives within those engineered confines. The “smart kitchen” is, in turn, embedded within the smart house and also presupposes a digital lifestyle. However, we argue that in order to get it right, to create spaces and technologies that people will want to use, not just admire from a distance, the domestic must be disentangled from the digital. One way to do this is to see the kitchen not just as a collection of wires, appliances, and Internet points, but as a space in which people really live.

As researchers working at sites of technology production and innovation—Intel Corporation and MIT’s Media Lab—we find ourselves increasingly preoccupied with the question of how one designs, not for efficiency, but for experience, affect, and desire.⁶ The challenge is to make sense of people’s daily practices so that these practices can meaningfully inform design and innovation. Although many technologies have now migrated from the office to the home, the underlying notions about how they should operate once in the home have not undergone similar shifts. With the notable exception of the television, which is profoundly homegrown, most new domestic technologies embody notions of efficiency—designed to improve time and resource management.⁷

I. From the houses of tomorrow to the smart house: the domestic sphere on display

The house of tomorrow is an exhibition house. It was designed to demonstrate mechanical equipment and new building materials that are now on the market. The house of tomorrow is an

efficiently designed house. The chief concern of the architect was not to give a specific form to his building, but rather to find a solution to the many and varied new requirements of a residence in a simple and direct manner. The causes were considered first, the effects later. He started from the inside and worked out.⁸

The Crystal Palace Exhibition of 1851 feted the achievements of British industrialism. It also launched a new era of expositions in the United States and Europe that would henceforth conflate science, technology, progress, and the spectacle. Throughout the later years of the nineteenth and the early years of the twentieth century, expositions celebrated the marvels of engineering – the steam engine, the safety elevator, photography, the telegraph, the internal combustion engine, radio, the phonograph, and motion pictures. During Chicago's World Fair, the Columbian Exposition of 1893, domestic science and home economics were presented as new academic disciplines in the United States, thus bringing the domestic sphere into prominence as a celebrated site of technological intervention and invention.⁹ At first, the domestic appeared only in the form of new labor-saving appliances. Gradually, these appliances were embedded within domestic settings, with the home first materializing as a painted backdrop and then, slowly, becoming three-dimensional.

George Keck's design for a house of tomorrow, featured in the Century of Progress International Exposition held in Chicago in 1933, emphasized efficiency and confirmed the domestic as an appropriate sphere for technological intervention.¹⁰ By contrast, the redesigning of British homes in the early twentieth century, rather than emphasizing efficiency, was concerned with "notions of adaptability, mobility and change," which were mapped onto powerful utopian ideals of the day.¹¹ Commencing with postwar reconstruction in the 1920s and peaking after World War II, the British home underwent a

significant transformation, which culminated in an open-plan interior. This new open-plan design attempted to create “the optimum conditions with regard to quantity and quality of fresh air, sunlight, and proximity to nature.”¹² And while efficiency was part of the new plan, far more important were the attempts to rewrite social conventions – doing away with the hierarchy of rooms that had segregated class and gender to create mass housing in high-density urban areas. Conversely, the emphasis in the United States was on the development of suburban, single-family, privately owned homes.

To understand how efficiency became the key to designing the American house of tomorrow, one needs to look to the impact of Frederick Winslow Taylor on American industry. In his remarkable biography of Frederick Winslow Taylor, Robert Kanigel (1997) argues compellingly that efficiency, as a value within American culture, appeared only recently.¹³ He writes that it was not until the late 1910s, that is, after the publication of Taylor’s *Principles of Scientific Management* in 1911, that America began to consider efficiency a primary virtue.¹⁴ Since then, efficiency has been so naturalized as to be almost invisible, its logic so entrenched in American culture that we have a hard time identifying its impact:

Taylor’s thinking ... so permeates the soil of modern life we no longer realize it’s there. It has become, as Edward Eyre Hunt, an aide to future President Herbert Hoover, could grandly declaim in 1924, “part of our moral inheritance” ... Taylor bequeathed a clockwork world of tasks timed to the hundredth of a minute, of standardized factories, machines, women and men. He helped instill in us the fierce, unholy obsession with time, order, productivity, and efficiency that marks our age ... Taylor left a distinctive mark on American life and the world ... he quickened the tempo of our lives, left us more nervous, speedy, irritable ... all concur that if we obsessively value time, jealously guard what we

have of it, and contrive to use it 'efficiently,' we must look to Taylor for the reasons why.¹⁵

In the United States, Taylor's impact on manufacturing and industry is arguably unparalleled, though it is worth noting that his ideas found less traction in Europe, which has allowed for a degree of slippage between technology and efficiency unimaginable in the United States. In this interstice, design that follows form as much as function has flourished. Thus, in the European appliance industry, design currently occupies a position of greater prominence than in American industry. In any case, Taylor's influence in the U.S. extended into the design of appliances and the architecture of the home, and American domestic science owes much of its success in the twentieth century to him and several of his energetic followers.¹⁶ Lillian Gilbreth, who was married to one of Frederick Taylor's closest collaborators, Frank Gilbreth, conducted some fascinating experiments in the kitchen, eventually developing a floor plan for kitchen spaces she called "continuous."¹⁷

These kitchen spaces minimized unnecessary motions and movements, but ultimately – and perhaps most importantly with respect to this paper – allowed and encouraged customization and flexibility.

[She] recognized that there was more than one "correct" way of doing things, and their aim was to help people discover solutions that would suit their individual needs... Lillian Gilbreth's flow process charts and micro-motion transfer sheets were intended to enable the housewife to organize the home according to *her own* work habits. She continually reminded her readers that there was no ideal solution; the height of a kitchen counter must be adjusted to the height of the person, and the most useful layout of appliances would vary from one household to the next.¹⁸

One of Gilbreth's colleagues and friends during this period was Christine Frederick. Together they worked on several projects concerning the electrification of the American kitchen. In the teens and twenties, Christine Frederick, capitalizing on Taylor's expanding influence, called for the transformation of the home into a site of modern, clean and hygienic, and above all efficient, production.¹⁹ Of the kitchen in particular Frederick once wrote, "It is the wrong idea that many women have of making their kitchens look like other rooms, with tools tucked out of sight. A kitchen is a workshop, where efficiency should rule over mere looks."²⁰

In the 1920s, Frederick's ideas about domestic design briefly found favor in Germany. Margarete (Grete) Schütte-Lihotzky, one of Ernst May's collaborators, designed a kitchen to be incorporated into a housing development project in Frankfurt.²¹ The Frankfurt Kitchen, as it later became known, featured black linoleum work surfaces and blue cabinet fronts—Schütte-Lihotzky believed the deep blue shade would repel flies. One historian of architecture described her kitchen as "... a kitchen in the form of a laboratory, with specific types of work surfaces, drawers and cabinets for specific functions and utensils."²² Schütte-Lihotzky's kitchen was mass-produced and installed in ten thousand houses in Frankfurt in 1927.

This positioning of the kitchen as a workshop and laboratory is key to understanding the ways in which the domestic sphere was subsumed under the rubrics of industrialization and scientific rationality. Bringing the kitchen into the technological space meant emphasizing the implementation and use of technology of the future, at the expense of supporting real people and real practices in the present. Indeed, in houses of tomorrow, kitchens became a nexus for innovation and development.

Unlike some of the other spaces and places that were transformed by Taylor's zeal, the kitchen was the one most unambiguously associated with a

gendered division of labor. The kitchen was a female space; in many ways, it still is.²³ In the 1910s and 1920s, suffragettes (and their friends Gilbreth and Frederick) advocated new technologies for the home, hoping that these might liberate women from the domestic round and allow them access to the workplace or education. Yet, reading Frederick's plan for a well-managed home, one is left to wonder whence the spare time to pursue other interests might come. Take, for instance, this Monday schedule for a family of five, without labor-saving equipment.²⁴

6:00-6:30	Rise and dress; start water heater
6:30-7:00	Prepare breakfast
7:00-7:30	BREAKFAST
7:30-8:30	Wash dishes; straighten kitchen; inspect ice-box; plan meals for Monday and Tuesday
8:30-9:00	Prepare towards lunch
9:00-10:00	Bedrooms, bath and hall cleaned; sort and prepare soiled linen and laundry
10:00-11:00	Thorough downstairs cleaning
11:00-11:30	<i>Rest period</i>
11:30-12:00	Serve lunch
12:00-1:00	LUNCH
1:00-3:00	Lunch dishes; prepare cooking for Monday and Tuesday; mop kitchen
3:00-4:00	Sewing and mending
4:00-4:30	Soak clothes and prepare for next day's washing
4:30-5:30	<i>Rest period</i> ; play with children; walk, recreation, or market
5:30-6:00	Prepare supper

6:00-7:00 SUPPER
7:00-7:30 Wash dishes

There is no time in this day for anything other than housework. The movement for more efficient housekeeping came from a culture that assumed that the woman's place was in the home; efficiency was supposed to enable women to begin to free themselves from domestic isolation and drudgery. However, as feminist scholars have long argued, labor-saving devices have not had that effect. Indeed, there is a significant body of literature to suggest that women spend just as much time engaged in domestic chores as they did fifty years ago, although they are now frequently also wage earners.²⁵

The scientific engineering of the home in the 1920s presupposed that women would be the principle users and occupants of that space; thus, the designers created spaces, practices, and technologies that have reproduced, rather than challenged, gender divisions. The smart home movement of the last decade has proceeded with only the vaguest reference to users and occupants. And, one might argue, in their attempts to create technological solutions for the home, engineers have forgotten that these homes have occupants at all.

Displaying the Home

The Century of Progress exhibition of 1933 included the *Armco-Ferro Enamel House* and *The Masonite House*, and from 1957 to 1967 Monsanto's *House of the Future* was a staple at Disneyland's *Tomorrowland*. This shift from the emphasis on science and technology inherent in the Century of Progress exhibition to Disneyland's spaces for entertainment and public consumption is indicative of the relationship between the house of the future and the media. Today's public perception of the future is more influenced by *Star Trek* and *The Jetsons* than by any smart house ever built.

The house of the future was always on display – it inverted the traditional relationship between public and private, opening private spaces to the public gaze. When displayed at World’s Fairs, Expos, and Trade Shows, these “vision houses” were inhabited by models and actors. The performance of domesticity that was meant to lend a degree of credibility to these vision houses merely reinforced their spectacle-like qualities, distancing the audience from their new homes. One of the many ironies here is that, while the houses of the future were designed for display as much as habitation, the vision of lives in these homes became progressively more insular and isolating.²⁶ These houses were disconnected from any broader sense of community, both at the time of display and in their implementation. Technology played on the American ideal of self-reliance: such houses promised a kind of island-like existence, where the family was sheltered from the world, and all interactions beyond the home could, and would, be mediated through technology. It is no coincidence that much of the current popular media coverage of smart homes is rife with anxieties about surveillance, privacy, and security.

The house of tomorrow is a vision perpetually deferred, one that tells us more about the preoccupations of the time than about the designs of the future. It is interesting, then, to reflect on the semantic shift that seems to have occurred within the last ten years: the language of houses of tomorrow has been replaced with talk of digital – or “smart” – houses. Articles on smart houses refer to home automation, energy costs, interactive appliances, remote controlling, home networking, wireless devices, entertainment centers, and security. As one commentator put it, the smart house is a “fully computerized household that serves and even anticipates your daily needs.”²⁷ Taking a slightly different tack, the director of the Smart Homes Foundation in the Netherlands writes that “smart home technology is the integration of technologies and services, applied to homes, flats, apartments and houses and small buildings with the purpose of

automating them and obtaining an increased safety and security, comfort, communication and technical management.”²⁸

Whatever the exact spin, today’s smart house is predicated on seamless, pervasive, ubiquitous computing. The 1980s witnessed the wholesale migration of personal computers from the office to the home. Initially, these PCs represented an extension of the office space.²⁹ Due largely to the Internet—e-mail, instant messaging, chat rooms, and the world wide Web—the 1990s has seen the market for home PCs start to change, with consumers demanding both design and function better suited to their new domestic environments.³⁰ The current trend, in the United States at least, is to broadband technology that is always on within the home. Early reporting on the adoption of broadband in the U.S. and U.K. shows that these devices are promptly moved from office-like spaces to highly trafficked spaces within the home, principally the kitchen table (a clear indication of the centrality of the kitchen even now). The power of the Internet carries forward Taylor’s model of efficiency to a new century, one of zero-friction business models and optimal pricing algorithms.

This talk about, and interest in, smart homes/houses is manifested in the recent wave of corporate and academic collaborations for the construction of smart-home/house spaces. In the United States and elsewhere, corporations have taken a variety of tacks, ranging from creating their own buildings to sponsorship of academic research or outright purchase of its results. Academic institutions, too, have sought ways to create spaces for research and design, collaborating with industry partners and seeking funding from non-profit organizations. Most industry and academic ventures can be mapped onto a continuum from smart houses to smart homes, where the vertical axis measures the degree of consideration of users, experiences, and occupants. The constellation of smart domestic offerings can thus be evaluated by reference to efficiency, ergonomics, and simplicity.

Smart Houses & Smart Homes: Corporate Research³¹

In today's corporate settings, smart-house spaces recall the houses of the future, in both sensibility and rhetoric. These are not spaces one can easily imagine inhabiting. They remain stages for performances, rather than spaces for lives. They are also, for the most part, concerned with advancing a particular brand or corporation, without necessarily creating a coherent vision for the future.

Exemplifying the corporate smart house is the Australian-based Copper Development Center with its emphasis on infrastructure, not daily activities. In a recently built display home in Kellyville, in the Sydney suburbs, a wiring system is key — one that can support telecommunications, security, audio, lighting, and gardening. John Fennel, CEO of Copper Development, says, "Smart Wired Houses are a technological evolution that would enable new homebuilders to 'future proof' their homes."³² One can only marvel at the irony of a smart house that must itself be future-proofed.

For appliance companies, the smart house space provides an appropriate venue to showcase new devices and new visions and seed new consumer aspirations. Siemen's *Smart Home* in Milan boasts "a glimpse of how fashionable and effortless living can be in the 21st century."³³ Furthermore, their Web site proclaims:

The kitchen is the heart of any home, and needs to be beautiful, inviting and full of the best appliances that money can buy ... And the coffee-making machine is tantalising. Whether it's an espresso, cappuccino or plain filter you prefer, all you need do is touch the FingerTIP sensor, and the Biometric Coffee Machine will know exactly the coffee you want and make it just how you like it.³⁴

Here the emphasis is on a lifestyle, not a life. For Matsushita Electrical Industrial, the manufacturer behind such brand names as Panasonic, Technics, Quasar, and National, the emphasis is also on lifestyle – “Internet Lifestyle.”³⁵ In 1999, Matsushita built its own state-of-the-art model home in Tokyo. The “Home Information Infrastructure” (HII) house, which blends digital technology and consumer electronics, is currently featured on Matsushita’s Japanese Web site, as part of the *Exhibition of Dream Technologies for the 21st Century*.³⁶ The Web site has its own future family of cartoon characters, whose styling seems to owe a great deal to *The Jetsons*. The son, a young blonde boy, has a speech bubble over his head, declaring, “Let’s have fun with digital technologies!” while his mother, also blonde, and decked out in an apron, pearls, and heels, announces, “Our lifestyle will be changed by digital technology in the future.”³⁷ The HII kitchen display space is gleaming white with frosted green backlighting and is described as “an entirely new kind of kitchen.”³⁸ It boasts a home information terminal and a central control for appliances, including a networked electronic microwave oven that retrieves various recipes through the Internet, the fridge, and the air-conditioner. Here technology is the driving force.

Philips Design, the design arm of the European consumer appliance manufacturer, offers a very different take on the smart home/house, suggesting instead a “house of the near future.”³⁹ Unlike many other smart home/house spaces, Philips pays attention to the notion that people live in domestic spaces. The company’s 1999 traveling exhibition, *la casa prossima futura*, is underwritten by the belief that “the home of the future will look more like the home of the past than the home of today.”⁴⁰ In describing a vision of future domestic ecologies, Philips’s Web site suggests that

The Home of the Near Future will contain intelligent objects which can learn to behave in ways that fit our lives – that get to know our home environment, our relationships, our rituals of everyday

activities. The 'smart' objects, as well as the physical structure of the home, will contain and develop an intelligence which is designed to learn, anticipate and provide for our needs. Products will resemble familiar objects and furniture, with a greater relevance and significance to our home life than the 'black boxes' of today.⁴¹

Designing for specific relationships within the home, Philips distinguishes various domestic environments: living room, kids' room, home office, bathroom, kitchen, dining room, and bedroom. In Philips's near- future kitchen, "the latest technologies that allow hands-free food preparation, internet browsing for recipes, electronic chef advice, fresh conservation of food, and instant analysis of the food's composition, are embodied in objects that are anthropologically meaningful, such as an apron, scales, a glass toaster, etc."⁴²

While these appliances delight with their playfulness, sincerity, and novelty, the virtue of efficiency is still their underlying assumption. Philips has developed a library of whimsical objects, which all politely recharge themselves, enable instant communication, and avoid messiness in cooking in a perpetual striving for maximal effectiveness. The very concept of "hands-free food preparation" implies an emphasis on efficiency and minimizing mess; while *la casa's* vision and scenarios are beautiful, it is much harder to imagine the actual user.

For high-technology companies, the smart home/house represents an important potential site for the consumption of computing power and the use of the Internet. Along with appliance manufacturers, and sometimes in alliance with them, numerous companies are exploring such domestic arrangements. Microsoft's *EasyLiving* project is one such exploration, although its focus is on solving underlying technology issues. The goal of the *EasyLiving* project is to develop "an architecture and technologies for intelligent environments [where]

an intelligent environment is a space that contains myriad devices that work together to provide users access to information and services."⁴³ In attempting to think through the issues of management and control of multiple devices, however, the *EasyLiving* project has had to deal with the complexities of human occupation.⁴⁴ The project currently has several manifestations: the "Concept Home" in Redmond, Washington, and the Microsoft "Home" in New York, intended to "showcase more than 25 examples of new and emerging technologies" displayed in a "real home environment," namely an eight thousand square-foot loft in Tribeca.⁴⁵

Intel's Architecture Lab (IAL), a research and development laboratory in Portland, Oregon, has its own vision of the smart home space.⁴⁶ Intel has recognized that the home is a distinct "ecology," a system and a space with its own rules and relationships: it is no longer enough simply to develop technology for the office and transfer it elsewhere. (A number of anthropologists have explored this notion of ecology; and though we are mindful of Harmeet Sawhney's injunctions regarding the power of metaphors to shape and ultimately limit thinking, we find the organic-ness of the term productive.⁴⁷) In the spring of 2000, IAL released a video for the "connected home." Following the lives of a family spread across three cities, three time zones, two countries, three households and four generations, the video offers an evocative statement about how it might feel to live in a smart home:

The connected home is a good place to live. An invisible pulse flows through every room ... the pulse is the Internet ... The connected home empowers the people who live in it ... The connected home facilitates and enhances the thousand daily interactions that make a family close, make friendships work and businesses prosper and communities thrive. From PC-connected devices within the home, to outside links the web of connections is

seamless and natural ... Connection is many things. It is a basic human need, and at the same time, our highest calling. Follow this calling and you'll find yourself home.⁴⁸

This notion of connection grew out of the work of People and Practices Research (PaPR), a small team of social scientists and designers working within IAL. Members of PaPR, including Genevieve Bell, have been conducting ethnographically inspired research on the home since the mid 1990s, and their work has helped shaped IAL's research and development agenda.⁴⁹ In the last two years, Bell and colleagues have conducted fieldwork in the U.S., Western Europe, Latin America, and Asia, focusing on the ways in which people occupy, use, and talk about their domestic spaces.⁵⁰ While PaPR does not currently have its own domestic space for design, it has found ways to bring some of those sensibilities to the R&D practice at Intel.

Smart Houses & Smart Homes: Academic Research

With support from industry partners, a number of academic research institutions also have constructed domestic design spaces, which provide students and faculty with real venues to explore technology within the home. Unlike many of their corporate counterparts, these spaces are actually inhabited, even if only on a trial basis.

The *Aware Home* at Georgia Tech is an interesting case in point. The Aware Home Research Initiative is "a focused research program, whose goal is to develop the requisite technologies to create a home environment that can both perceive and assist its occupants."⁵¹ Researchers at Georgia Tech felt that in order to design technology for the home, they needed to have a home in which to design: "Because we feel than any significant research in this area must be conducted in an authentic yet experimental setting, we are building a home that will serve as a living laboratory for ubiquitous computing in support of home

life.”⁵² The home, some 5,040 square feet, will consist of two independent, two-bedroom living areas. One living area will serve experimental purposes, the other will be occupied by actual residents.⁵³ This home represents a radical reinvention of the smart house format, and, above all, reclaims the smart house as a smart home.

Very different is the Rhode Island School of Design's *Universal Kitchen*.⁵⁴ In 1993, an interdisciplinary team of students and faculty from Industrial Design and Interior Architecture, in partnership with a range of foundations and corporations, initiated a project to “recreate the kitchen, an everyday icon of poor design.”⁵⁵ Like many other collaborations in this area between industry and academia, there were no obvious key players; the *Universal Kitchen's* sponsor list reflects a diversity of investors and interests.⁵⁶

In looking at RISD's *Universal Kitchen*, one is reminded of Lillian Gilbreth's “continuous kitchen.”⁵⁷ Gilbreth's kitchen design was also based on extensive studies of use and sought to solve a very similar problem. And while it is possible to argue that Gilbreth designed her kitchen with able-bodied female homemakers in mind, she did undertake several projects with amputees and took a range of disabilities into account in her domestic redesigns. Contending that the American kitchen has not changed in basic design and configuration since Gilbreth, the *Universal Kitchen* project offers a new interpretation of this domestic space. Some four hundred subjects were studied making a succession of simple pasta dinners in a range of typical kitchens. What emerged from this research was a sense that existing kitchens lack a “Comfort Zone” — “the vertical space in the kitchen where items can be reached without having to squat, stretch or strain.”⁵⁸ Working around this observation and its implication for an expanded range of kitchen users, two full kitchen prototypes were built: one for a large family living together (“Max”) and one for an individual or couple in an apartment (“Min”). Both the Max and the Min kitchens were built with modular components that could be custom selected and arranged to suit “... people of all

ages and physical abilities.”⁵⁹ The *Universal Kitchen* went on display at the Smithsonian’s Cooper-Hewitt National Design Museum in 1998. In September of the following year, the Maytag Corporation announced that it had signed a technology transfer agreement with RISD. Under the terms of the agreement, Maytag obtained exclusive worldwide rights to the *Universal Kitchen*.⁶⁰

The Massachusetts Institute of Technology has a long and varied history of creating domestic spaces. Under the direction of Ellen Swallow Richards, an instructor in Sanitary Chemistry and Sanitation and MIT’s first female graduate, the Rumford Kitchen was constructed and displayed at the World’s Columbian Exposition in Chicago in 1893. According to Richards, the intent of the exhibit was to “illustrate the present state of knowledge in regard to the composition of materials for human food, the means of making these materials most available for nutrition, and the quantity of each necessary for a working ration.”⁶¹ Versions of this kitchen were subsequently installed in the women’s dormitories at the University of Chicago and in a hospital for the insane in Kankakee, Illinois.

Nearly a century later, in the late 1990s, MIT’s architecture department embarked on an ambitious project to explore domestic spaces, *House_n*: “The problem of our epoch is the problem of the electronically mediated home.”⁶² Recently, the department has created its own *Living Laboratory*, which is designed to “allow for long-term, scientific studies of occupants and their relationships to their environment and the technology of the home.”⁶³ This 1700- square-foot single-family prototype house grew out of several years of research that examined the ways in which people occupy their domestic space. The *Living Laboratory* aims to test architectural strategies for developing small and efficient living spaces; to successfully integrate and embed digital technologies in building materials; to explore the arena of home-based preventive medicine; and to create prototypes of energy and resource management systems. Underlying these aims is an ongoing attempt to establish an appropriate way of controlling and interacting with all of this technology. According to Kent Larson, the

project's director, the *Living Laboratory* will help to create a smart home: "It will be a house that adapts to you, changes with you, does, in effect, whatever you ask."⁶⁴

At MIT's Media Lab, the Counter Intelligence group, including Joseph Kaye, has created its own design and display space. The smart kitchen space, known as *La Cantina*, is now two years old. Housed in the basement of the Media Lab on the MIT campus in Cambridge, Massachusetts, *La Cantina* is an unexpectedly intimate domain. Unlike many other smart house spaces, this one has a sense of occupation and use. The glass wall opening onto the corridor is lined with potted herbs, in varying states of green and decay. A counter top is busy with spice jars, canisters, open containers, and recipe books, while the sink almost invariably contains dirty dishes. Even the smell of coffee sometimes fills the small room as researchers gather to talk.⁶⁵

Yet this kitchen blends social practices and technology in innovative ways. Wendy Ju's *counterActive* elegantly implements an interactive recipe in the kitchen, inventively using physical space.⁶⁶ Concealed beneath the one-inch-thick counter is a capacitive touch sensor: the recipe is projected down onto the counter, and the cook touches the countertop to move through the recipe or to glean greater details. Recipes contain side links and facts; a cherry tart recipe will tell you the number of cherries on an average tree, and a recipe for *Chicken Provençal* includes the sights and sounds of a typical French market. *counterActive* blends in with the environment and architectural space of the kitchen. Its focus is not to make meal production more efficient, but to enhance the experience of cooking. This is the first computerized recipe system we have seen that not only expands on the conventional cookbook by incorporating pictures, audio, and video, but also deals better with being covered with spilled milk.

Joseph Kaye designed *La Cantina* before all the details of the research plan for Counter Intelligence were clear. Yet its design recalls many apartment kitchens. It is laid out along three sides of a square with appliances, counter

space, and shelving; only the glass wall to the corridor betrays its unique location. The twelve-by-twelve-foot square is cramped as a research space, and we have found that the current implementation doesn't give us enough room for sitting around a table and talking – the same problem that faces many urban dwellers. The use of the space, though, has evolved over time. Following a two-year occupation, we have redesigned *La Cantina* on paper, removing a wall of counter space and placing a round wooden table in the center, thus establishing conversation and communication as central activities.

II. "Don't they have kitchens in America?" Getting beyond the smart kitchen

When talking about kitchens, it is easy to succumb to stereotypical visions of domestic life. It has become a cliché to contrast European family dinners of homemade organic foods (consumed at leisure by smiling extended families) to American family dinners of microwaved fast food (consumed in twenty minutes of television watching). However oversimplified this view, domestic life in western Europe provides an interesting counterpoint to the smart home/house vision and a potentially useful critical lens for examining its logic. While western Europe shares a great deal of cultural history with the U.S., it does not share the American embrace of Taylorism and its accompanying notions of efficiency. Furthermore, in Europe there is a greater separation of home and work life.

In May 1999, Bell and a colleague conducted a pilot field study in a small community in northern Italy.⁶⁷ We were interested in understanding how people occupy and use their own domestic spaces, how those domestic spaces are embedded in the larger community, and how technology facilitates (or hinders) those occupations, uses, and relationships.⁶⁸ We arrived shortly after the Columbine school shooting in the United States, and American culture was under much scrutiny in the Italian media. Sitting around Francesca's kitchen

table, we were asked what the family room was.⁶⁹ Bell explained that this was a space in some American homes where families gathered to talk, watch television, do homework, play games, read, eat, and spend time together. Francesca looked surprised and asked, “Don’t they have kitchens in America?”

La tavola é la vita : The table is life

In northern Italy, meal times remain important to the family, the household, and the village. The largest and longest meal is eaten at midday. At about one p.m., shops close their doors, government offices shut down, children come home from school, and the streets are quiet and empty. Almost everyone is at home, and almost everyone is eating. The lunch hour extends to several hours, and activity outside the home does not resume until after three p.m. This daily rhythm of long lunches and of time spent together is considered a vital part of what it means to be Italian. Women we interviewed worried that if Italy continues to “modernize,” moving to a nine-to-five schedule and otherwise following the American model of efficiency, their way of life would be disrupted, perhaps even destroyed.

Francesca’s home is on a main access road into her small Italian town. There is no sidewalk to speak of, and her high metal fence and gates front onto the street. Standing at her gate and ringing the buzzer require paying careful attention to the traffic while simultaneously listening for Francesca’s voice, tinny through the house security intercom. On the first day, I was received through the front door; on subsequent visits I was expected to come through the side door directly into the kitchen. Francesca explained that the front door is really just for “priests and tax men.” This layout of the house – the kitchen away from the street, at the back, with its own side entrance – is common in Italy.

The kitchen is the central social hub of Francesca’s home. It is a long, cluttered room, about ten-by-fifteen feet, with three doorways: a side entrance into the driveway for family and friends; the step-up doorway to the rest of the

home; and the back door onto the covered patio space where the laundry hangs to dry amid a seeming chaos of boxes, chicken coops, flower pots, and old bicycles. Appliances and cabinets line the walls; the family's calendar and recycling schedule is attached to the side of the freezer. The table always has a cloth—slick plastic at breakfast, fabric for the main meal in the early afternoon. On the room's second table, against the wall, is the household's main television and cable. In front of the television, there are bottles of oil, food in various stages of preparation, and the bits and pieces of any kitchen—a cordless telephone, pieces of paper, the detritus of a five-person household. Everything happens in this room—cooking, eating, talking, homework, watching television, socializing, paying bills, organizing children and calendars and travel, looking at photos, sitting quietly. And the table is the center of it all.

Spending time in Francesca's kitchen, I quickly realized, meant spending time at the center of her household. At lunchtime, Francesca's whole family gathers at her table—her husband comes back from working on their new home, her youngest children come home from school, her eldest daughter stops practicing the piano and goes two houses down the street to collect Francesca's mother-in-law and bring her to lunch. Francesca spends the morning shopping and cooking in preparation for this main meal. Her choices of food reflect her concerns regarding her family's health and well-being, as well as seasonal availability. The food served at Francesca's table also recalls the way Francesca is located within a broader community—she serves cold meats cured by her brother, liqueurs distilled by her aunts, bread that is delivered to her door, fish that is only available at the markets on Mondays. Eating at Francesca's table is also a subtle encounter with the history of her family—each meal I ate there told a different story—pasta from the town in Romania her grandmother left behind, baby song birds from the mountains where her father's family has lived for years, lamb shanks marinated with rosemary and served with slabs of bread “as

the Romans did it," a recipe for tiramisu learned from her mother-in-law. Food was not just sustenance; it was identity.

Thinking about kitchens as sites for social activity and exchange reveals an important facet of the smart home/house debate. Technologies designed for domestic use play important cultural roles in daily life. Preserving the role of food as story-teller and meal time as a space and site for the production of meaning requires a willingness to think beyond digitally enhancing food preparation.

Alle zusammen: All together

We conducted fieldwork in southern Germany in the summer of 1999, spending time in a small town, as well as in several larger industrial cities to the north. German domestic spaces were, for the most part, larger than their Italian counterparts and were organized according to different social principles. German domestic spaces reinforce some of the key themes of German identity in the post-World War II era. Germany is still acutely aware of its role in twentieth-century history, and contemporary Germany society emphasizes the family as a social unit and cultural safeguard against mass societal policy. This emphasis on the family was evident at meal times.

Along with her husband and three teenage children, Eva lives in a small rural village on the outskirts of a larger town. An architect, she designed the home she currently shares with her family; it is large, with an open-plan layout. Like many German houses, it has distinct seasonal zones: a front patio and sun porch occupied throughout the summer months, and a large wood stove that heats the living room and dining room in the winter. German eating spaces, too, are typically seasonal: long summer meals are eaten in the garden under a bower, winter meals by a roaring fire. As such, trends in German eating spaces differ from those in, for example, the U. S., where kitchen spaces are typically becoming integrated into eating spaces. In many German homes, the kitchen is

no longer tucked into a corner of the house but has moved out into the open, though it has not yet become an all-purpose room.

Eva's kitchen is carefully designed. Long and narrow, it has a window looking out onto cornfields, a built-in breakfast table nook, and doorways leading off into the open dining room/living room space and back into the hallway near the bathroom and laundry. Eva paid close attention to the details: her spice rack is arranged in a narrow cupboard that pulls out vertically. She has built-in bins for flour and grains, specific places for vegetables and fruits, and shelving for her small appliances. Her dishwasher and stove are designed to conserve energy, and she has a large recycling space downstairs.

Although the kitchen is not the focal point of Eva's home, meal times are. It is extremely important to Eva that her whole family eat together. The main meal of the day is frequently *Mittagessen*, lunchtime. After the children have gone off to school, Eva tidies up a little, and then goes shopping at her local market, filling her wicker basket with enough food for the day and no more.⁷⁰ Eva then returns home and makes the main meal of the day. Eva's husband comes home from the office every day at around noon, and they eat lunch together. Her kids come home from school shortly thereafter, and she feeds them, too. In the winter, they sit inside at the dining room table; in the summer months they go outside. Eva says that she really likes it when her family can eat *alle zusammen*.

This desire to eat together, as a family, as a household, was expressed repeatedly. It became abundantly clear that meals are a sort of social ritual, the time for everyone to be in the same space together. As such, meals and meal times – though not necessarily the kitchen itself – act as a site for the production of meaning, in this case, that of family, household, and community identity. As we think about designing technologies for meal times, we need always to ask whether design supports the rituals of mealtime.

Quand on a soif, on va au café : When you're thirsty, go to a café

In the fall of 1999, we spent nearly three weeks in France traversing the country from the small villages of Brittany to Paris. One cannot conduct fieldwork in France without being acutely aware of the importance of food. Meals, food, cooking, and eating are all discussed with strong emotions. Food in France signifies pleasure, relationships, enjoyment, and desire. It signifies the expression of strong local, regional, and national identities. It signifies a respect for the senses, manifested in pleasing combinations of tastes, colors, and textures. Having a favorite brasserie, knowing the best place to buy crepes on Montparnasse, spending Saturday morning going to three *boulangeries* to get the right baguette, the right croissant, the right *pain au chocolat*—via its link with conversation, food contributes to the continuity of the social fabric. Generally speaking, tradition has not been abandoned for efficiency.

It is not so surprising, then, that the local *marché* is an inherent part of life. In Brittany, the women we interviewed followed their local produce market as it moved from small village to small village—Auray, Hennebot, La Trinitie, Vannes, Carnac. Even in Paris, people talked about their preference for local produce markets—they go to the *marché* for fruit, fish, wine, cheese. Certainly they shop in the *hyper-prix* (supermarket) for water and toilet paper, but when they want to cook, they still go to the *marché*. “Markets are amazing,” one woman told me. “They are our history, an old tradition—you bargain, you touch, you smell, you look. You meet people and discuss things, you socialize.” Listening to the way people talk about the *marché*, it is clear that the market is intimately linked to domestic spaces and daily lives.

Madeline lives in Paris with her sixteen year-old son, Pierre. Her husband died suddenly three years ago, and she has been raising Pierre on her own. She is a housekeeper, and we interviewed her in the household that she runs. She arrives there at about nine a.m. every morning, taking the metro, stopping to place an order for a special cut of meat at the butcher’s, and grabbing a newspaper to read on the way. At around one p.m. she leaves her place of work

so that she can go home and have lunch with her son. Pierre is in a private high school a ten-minute walk from their apartment, and he comes home for lunch every day.⁷¹ Madeline always prepares something the night before. For her and Pierre, "*Le diner est un moment privilégié.*" She loves to shop for her son, because he loves to eat. It is never a chore to buy and cook food, she says, because it creates the moments you spend with people you love. When her husband was still alive, he would come home and say "What's been cooking?" To Madeline that always meant he had been thinking about what she might be making for him and for them. Food and eating were *un des plaisirs de la vie*.

This notion of food as pleasure and of cooking as an expression of love and attachment sits very uncomfortably in the current world of smart houses and smarter kitchens. The objects and activities we seek to have in our kitchens extend over a wide range of cultural values and registers.

Some extremely useful ways of interrogating the domestic sphere and of locating it within broader historical contexts, consumption patterns, and government regulations have appeared in two edited collections, focused principally on Europe and the U.K.⁷² What is clear both from this work and from our own ethnographic work is that the kitchen is an important space within the home. Its function and the experiences and activities it supports vary from culture to culture, context to context, even season to season. We have seen kitchens that were showpieces (mostly in the U.S.); kitchens that were the social hub of the home (Italy); and tiny kitchens (mostly in the U.K.). We have seen a full range of appliances, from fridges to automatic polenta stirrers to water dispensers. What remained a constant, however, was the fact that people talked about these kitchens as places in which they lived. This attitude must be considered in assessing the intersection of the digital and domestic worlds.

III. Our Manifesto: think domestic, not digital

...be guided by convenience, not convention, consider the personalities and habits of our family, yourself included.⁷³

Food, cooking, and kitchens represent a significant set of icons in most cultures. They are evoked, deployed, and employed as metaphors and as shorthand – stand-ins for longer conversations and more complicated plays of meaning and history.⁷⁴ Recipes are family secrets, national identities, corporate mysteries, poetry. Foods are memories of lovers, vacations, childhoods, family dinners gone wrong, family dinners gone right, first dates, last dates, and shared memories. Cooking is a chore, an act of love, a ritual, a lesson.

Yet, in the American corporate context, food is often regarded as fuel, cooking a task, and the kitchen a site ripe for Taylor-like interventions. Indeed, over the last century, American kitchens have been the ongoing sites for projects to reduce cooking to a domestic science, the kitchen to a collection of labor-saving devices, and food to exercises in packaging. Of course, this corporate concept of the kitchen is by no means hegemonic, and in both the U.S. and western Europe it is possible to find other models for understanding the “kitchen.” Such alternative models (for example, those we discovered in Italy, Germany, and France) provide one way of reclaiming the kitchen as a significant “ecology” with its own interplay of objects, actors, and experiences. By mapping ethnographic research to design concerns, we can imagine anew the relationship among food, cooking, and kitchens, one that does not necessarily privilege technology.

Thinking Digitally

As technologists designing for the kitchen, we are most frequently thwarted by the ways in which food technologies are portrayed in popular media: How can we ever compete with the replicator on *Star Trek's* Enterprise (“tea, Earl Grey, hot”), *The Jetsons*, Rosie the Robot, or the Chocolate River in

Roald Dahl's classic *Charlie and the Chocolate Factory*?⁷⁵ The expectations of perfect performance, boundless resources that require no storage, the right food, and no labor are impossible to meet.

Fundamentally, however, these dream technologies are all aimed at supporting idealized experiences that would seem to be appropriate when designing for the home. Clearly, one solution is to better understand what people are already doing in their domestic spaces and design around those activities, as is illustrated by the ways in which Francesca, Eva, Madeline, and their American counterparts use their kitchens. Another approach is to document what people cannot do in their domestic spaces, but for which there is a historic preference or an expressed desire.

At least one Counter Intelligence project – *Robocrop* – has taken this approach.⁷⁶ *Robocrop* augments a hydroponic kitchen garden with sensors and actuators to help the cook feed and nourish plants and keep the owner up-to-date on their current state. Despite some dramatic failures, our kitchen garden currently produces tomatoes, peppers, and a complement of cooking herbs – rosemary, basil, mint, Greek oregano, and the like. This technology could enable today's cook compactly and efficiently to have a kitchen garden within the walls of a cramped apartment. Unfortunately, *Robocrop* remains at the mercy of hydroponic technology, which is by no means flawless. Yet even in its less-than-perfect state, *Robocrop* offers a glimpse into a kitchen that might support a wider range of domestic activities, not overtly digital ones.

Other Counter Intelligence projects address the distinction between food preparation as a transaction and food preparation as an experience. Reheating a microwave burrito is a transaction, as time is spent merely waiting for the process to finish. *PC Dinners* uses the existing barcode on prepackaged foods to identify the optimal cooking time -- and more. Scanning the barcode on a package of frozen Danish gives instructions from the "Danish Chef": "Pleese-a poot zee fruzeigen Daenish in zee microvave." The food is cooked as music plays.

The music is chosen to correspond to the cooking time: the end of cooking is signaled by the end of the music and a warning from the Danish Chef not to burn yourself on the hot Danish. *PC Dinners* is arguably a trivial application, but it draws attention to the poverty of interaction that a current microwave affords users, despite the ridiculously large number of buttons it presents as an interface.

A similar project is *Mr. Java*.⁷⁷ *Mr. Java* is a smart coffee machine: place your coffee cup with a thin tag glued to the base under the spout and it makes you the coffee that you want and gives you the news you want, too. Joseph Kaye gets the news from London and a double tall *latte*; others choose an espresso with their sports scores, or a cappuccino with the latest weather report. Again, this project aims to transform the act of making coffee from a transaction into an experience. It also suggests a different sort of convergence in the domestic sphere – a convergence not of devices, but of experiences.

More recent work has focused on properties of interaction in the kitchen. Kaye's Master's thesis focused on the role of scent in conveying information (a published interview with PAPER researchers reporting communication to be the primary activity that occurs in the kitchen inspired this project).⁷⁸ *inStink* communicated scents between one kitchen and another, or between a kitchen and any other remote space, such as an office. As dishes were cooked in the kitchen, the scents of the spices that characterize each dish were emitted at the remote location. The scents of ginger, cinnamon, and nutmeg may be associated with gingerbread or spice cake, but definitely convey information about a different set of foods than tumeric, cumin, and garam masala.

Thinking Domestically

There is a growing recognition within the technology industry of the importance of emotion and affect.⁷⁹ Philips, for one, recognizes this. In their *la casa prossima futura* they offer us "emotion containers" – lustrous nesting-doll-shaped objects:

Emotion containers are small, personalized multi-media products which contain a screen, a speaker and a scent compartment. They are designed to be given as special presents and are attractive on two levels: as cherishable objects in their own right, and as carriers of messages of significance.⁸⁰

Recognition of the importance of intimacy and communication has inspired further applications of Kaye's work with scent. *Honey, I'm Home* sits on an office desk and emits a burst of scent when a loved one is thinking of you. For example, Kaye has explored – on paper, to date – what an intimate dinner for two would involve if the participants were at Internet distance apart. Each side would see half an oval table with a large screen at the ending, giving the illusion of a single, connected table. Multiple microphones give multi-channel inputs to be played at the other end. Imagine, instead, an intimate dinner. The senses need only a chance to connect by means of a small video screen for glancing, not staring. Mikes and speakers are artfully installed so that you forget that they're there and can concentrate on what's being murmured, not on how the sound reaches you. There is a pair of candles: one lights when the other is lit. The sounds of a wine bottle being opened and of a chair scraping back at the end of a meal are important to intimacy in a different way than speech and vision, which carry raw data. The bandwidth of intimacy is narrower than you might expect; we can determine emotion before we can determine meaning in speech. Think of overhearing a conversation in a foreign language: you may not speak it, but you can distinguish among business discussions, arguments, and sweet nothings.

Yet traditional industrial/commercial views of the kitchen see the space as embracing a simple, beginning-to-end process: buy – cook – eat – clean. This is, indeed, logical, when all one is concerned about is selling tools for a single step of that process. Dishwasher manufacturers do not communicate with the

manufacturers of the food that their machines wash off; in fact, they barely communicate with the manufacturers of the dishwashing detergent their machines use. The place where this communication happens, when one realizes that the chain flows both ways and wraps around, is the home.

The short- and medium-term effect of poor, non-user-centered-design on the manufacturer is limited. In the United States, the replacement cycle for a fridge is thirteen years. Yet corporate America amortizes technology over a three-year cycle, and most other capital expenditures over five. Rarely do companies have more than a five-year business plan. In this environment, an economic calculation of a thirteen-year cause-and-effect is beyond the powers of corporate accountancy. It is the consumer who must put up with a contrived implementation of short-term money-saving values; we argue that it cannot fail to be the manufacturer who suffers, too, in the end.

How do you design for intuition: that alchemy of flour, butter, and sugar transformed into dough; the tension in a spoon stirring polenta perfectly made; the balance of spices remembered in the tip of a wrist? We argue for respect for the multiplicity of users and their skills, for carefully crafted observation, and for a respect for one's own product. We argue that there are invariably long-term gains for both producer and consumer in the simple awareness of where the experience occurs. The experience is the fundamental unit of interaction; no interaction happens in a void.

A Manifesto

We propose a kitchen/technology relationship that draws on and learns from the rich cultural history of the kitchen, and, above all, focuses on those who experience the space, rather than on the technologies that reside therein. We have drawn up a plan for the future of technology design for the home and kitchen—or, as we describe it, a kitchen manifesto. To summarize our arguments into a set of rules and guidelines for a new era, driven not by design or technology, but

from a concerted effort to learn from the mistakes of the last hundred years, we propose the following:

1. Value experience over efficiency
2. Understand the use of objects in context
3. Consider context to be cultural and dynamic
4. Pay attention to people and their experiences
5. Find and support rituals of domesticity

In this article, we have argued that it is necessary to disentangle the kitchen—and by extension other domestic spaces—from the relentless rhetoric and logic of the smart house. We have suggested a new approach to thinking about and designing for the kitchen specifically and for domestic spaces more generally. Our primary focus in this paper has been the West: the questions surrounding the kitchen as it applies to the United States, Canada, Australia, New Zealand, and Western Europe. We recognize that to design domestic spaces outside of the West is to encounter a whole other set of challenges and issues, but we feel that much of our material and conclusions will have salience in these other contexts. This new approach draws inspiration from a range of disciplines and intellectual practices, including anthropology, sociology, feminist theory, computer science, ethnography and human-computer interaction design, and grows out of some of the research and projects conducted within our respective home institutions. As one of us is a female social scientist in a company of male engineers, and the other a humanist in an organization of technologists, we have a unique vantage point. Our work is implicated in and mobilized for the design and development of new technologies, yet we remain outsiders talking back to our respective institutions in voices and about subjects they are sometimes unable to hear. It is our hope that this new approach privileges real people and real social practices, and in so doing challenges many of the ways in which industry has constructed and created the domestic.

¹ This paper began as a hyperbolic conversation about gastroporn at MIT's Media Lab in Boston. A flurry of e-mails followed, but the paper was written in a series of co-present moments in the U.S. and Ireland. Of course, this paper would not have been possible without the support of our respective institutions and colleagues, both local and digitally diasporic, and we thank them all. In particular, we thank Scott Mainwaring, Julian Orr, and Diane Bell for their close readings and insightful comments. We are also grateful to a number of researchers around the world working on their own smart homes, and in particular want to thank Thad Starner (Georgia Tech) and Michael Lye (Rhode Island School of Design) for their prompt responses to requests for additional information and helpful references. We thank Heinrich Schwartz (MIT) for pointing out to us Grete Schütte-Lihotzky's *Frankfurte Küche*. We also thank Darra Goldstein for her initial encouragement and continuing interest. Jofish would like to thank Julie Fresina for introducing him to *Glass Bottom Boat* and her ongoing support of *La Cantina*. Jofish's research is sponsored by the MIT Media Lab's Counter Intelligence Special Interest Group.

² Frank Tashlin, *Glass Bottom Boat* (MGM, 1966).

³ Mark Weiser once remarked that in the future, "we must dwell with computers, not just interact with them ... Dwelling with computers means that they have their place, and we ours, and we co-exist comfortably." See Mark Weiser, "{Open

House}" Interactive Telecommunications Program Review, 2.0., 1996.

<http://www.itp.tsoa.nyu.edu/~review/> (23 April 2001).

⁴ This notion of excavation owes much to Foucault, to cultural studies (specifically around notions of geography and place), and to recent methodological interventions in anthropology. See Michel Foucault, *The Archaeology of Knowledge* (New York: Harper and Row, 1972). In particular, we are drawing on Marcus's injunction to "follow the object." (See George E. Marcus, "Ethnography in/of the World System: The Emergence of Multi-Sited Ethnography," *Annual Review of Anthropology* 24 (1995): 95-117). We are also influenced by Daniel Miller's call to explicate material culture through an ethnographic lens. (See Daniel Miller, ed., *Material Culture: Why Some Things Matter* (Chicago: University of Chicago Press, 1998).

⁵ Rosalind Coward, *Female Desires: How They Are Sought, Bought and Packaged* (New York: Grove Weidenfeld, 1985), 65-66.

⁶ Joseph Kaye, *Symbolic Olfactory Display*, Master's Thesis, Massachusetts Institute of Technology, www.media.mit.edu/~jofish/thesis/. 2001; Tony Salvador, Genevieve Bell, and Ken Anderson, "Design Ethnography," *Design Management Journal*, vol. 10, no. 4 (1999), 9-12.

⁷ The television did not start out in the workplace, or the office, and migrate home. It was designed explicitly to be located within people's homes. It was also designed to be an entertainment device – the television is not about work, or

tasks, or efficiency. The television was also designed in such a way as to allow collective viewing.

⁸ George Keck, writing about “The House of Tomorrow” at the Century of Progress International Exposition in Chicago, 1933, as quoted in H. Ward Jandl, *Yesterday’s Houses of Tomorrow: Innovative American Homes 1850 to 1950, with additional essays by John A Bruns and Michael Auer* (Washington DC: Preservation Press, 1991), 31.

⁹ Martha Banta, *Taylored Lives: Narrative Productions in the Age of Taylor, Veblen and Ford* (Chicago: University of Chicago Press, 1993).

¹⁰ Keck’s house and four others from the Century of Progress Exposition are currently the focus of preservation efforts. Relocated to the Indiana Dunes National Lakeshore in the late 1930s, they have languished in disrepair for some 60 years. In 1999, a partnership between Indiana Dunes and the Historical Landmark Foundation of Indiana put the houses on the market, offering them for private occupancy and purchase in return for promises to restore them appropriately. See Robert Sharoff, “A Possible Future for the Houses of Tomorrow,” *New York Times*, 31 December 2000.

¹¹ Judy Attfield, “Bringing Modernity Home: Open Plan in the British Domestic Interior,” in Irene Cieraad, *At Home: An Anthropology of Domestic Space* (New York: Syracuse University Press, 1999), 73.

¹² *ibid.*, 75.

¹³ Robert Kanigel, *The One Best Way: Frederick Winslow Taylor and the Enigma of Efficiency* (New York: Penguin, 1999).

¹⁴ Frederick Winslow Taylor, *Principles of Scientific Management* (New York: Harper Bros., 1911).

¹⁵ Kanigel, *The One Best Way*, 7.

¹⁶ Ellen Lupton & J. Abbott Miller, *The Bathroom, the Kitchen and the Aesthetics of Waste* (New York: Princeton Architectural Press, 1993).

¹⁷ Lillian Gilbreth, *The Home-Maker and her Job* (New York: D. Appleton and Co, 1928).

¹⁸ Witold Rybczynski, *Home: A Short History of an Idea* (New York: Penguin Books, 1986), 191.

¹⁹ Christine Frederick, "The New Housekeeping: How it helps the woman who does her own work," *Ladies Home Journal*, no. 13, (September 1912), 70-71; *The New Housekeeping: Efficiency Studies in the Home Management* (New York: Doubleday, 1913); *Household Engineering: Scientific Management in the Home* (Chicago: American School of Home Economics, 1920, reprinted 1923).

²⁰ Christine Frederick, *Household Engineering*, 71. It is interesting to compare Frederick's vision to Martha Stewart's vision of a seamless future kitchen, unencumbered by visible cupboards, tools, or even table legs. See Martha Stewart, "Behind Closed Doors: The Kitchen," *New York Times Magazine*, 29 September 1996, 120

²¹ Susan R Henderson, "A Revolution in the Woman Sphere: Grete Lihotzky and the Frankfurt Kitchen", in Deborah Coleman, Elizabeth Danze, and Carole Henderson, eds., *Architecture and Feminism: Yale University Publications on Architecture* (New York: Princeton Architectural Press, 1996).

²² Peter G Rowe, *Modernity and Housing* (Cambridge: MIT Press, 1995).

²³ The notion that the kitchen is a gendered zone is reinforced in the media coverage of both Kaye's and Bell's current research projects. Reporters frequently assume that as a technological male in a technological kitchen, Kaye is pro-technology, eats nothing but instant noodles, and cannot cook. By contrast, recent articles about Bell located her firmly within the confines of the kitchen.

²⁴ Frederick, *Household Engineering*, 70, original emphasis.

²⁵ Ann Oakley, *The Sociology of Housework*, (New York: Martin Robertson & Company, 1974); Susan Strausser, *Never Done: A History of American Housework* (New York: Pantheon, 1982); Ruth Schwartz Cowan, *More Work for Mother: The Ironies of Technology from the Open Hearth to the Microwave* (New York: Basic Books, 1985); Juliet Schor, *The Overworked American: The Unexpected Decline in Leisure* (New York: Basic Books, 1993); John P. Robinson, John P. and Melissa Milkie, "Dances with Dust Bunnies: Housecleaning in America," *American Demographics* (January, 1997).

²⁶ Mike Davis, *City of Quartz: Excavating the future in Los Angeles* (New York: Vintage Books, 1992), 151-265.

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- ²⁷ Sean Doolittle, "Home, Smart Home: Building a Digital home today," *The Digital Home*, vol. 8, no. 6, (2000), 26.
- ²⁸ Ad van Berlo, "Smart Homes Foundation," *Smart Homes*, www.smart-homes.nl, 2000.
- ²⁹ Alladi Venkatesh, "Computers and other interactive technologies for the home," *Communications of the ACM*, vol. 39 no. 12, (1996).
- ³⁰ Genevieve Bell, "Thinking outside the box: theorizing the second chip revolution," Paper presented at *American Anthropological Association Meetings*, San Francisco, 2000.
- ³¹ For a sampling of future computing environments with a focus on smart homes, see: www.cc.gatech.edu/fce/seminar/fa98-info/smart_homes.html. For a different set of references and pointers regarding the history of 'houses of the future' and some current examples, try MIT's House_n Project's Web site: http://architecture.mit.edu/house_n/web/resources/links/otherhousesofthefuture.html.
- ³² Copper Development Centre, "Australia First to Launch Smart Wired Homes," *Copper News*. <http://www.australia.copper.org/pages/main/news.html>, 1999
- ³³ Siemens, "Smart Home in Milan," <http://www.siemens.ie/New/Smarthome.html>, 1999.
- ³⁴ *ibid.* One cannot help but be reminded here of Douglas Adams's own version of this machine – the Nutri-Matic, which produces, on request, "a liquid that was

almost, but not quite, entirely unlike tea.” Of course, that technology responded to natural language, providing seamless, albeit imperfect, service, and required the computing power of an entire spaceship to produce one pot of Earl Grey tea. See Douglas Adams, *Restaurant at the End of the Universe* (New York: Ballantine, 1980).

³⁵ As the flurry of interest and accompanying speculation in the economic potential of the smart home grows, there have been a number of interesting corporate partnerships and strategic alliances. In October 2000, MEL joined together with 3Com, BestBuy, Cisco Systems, CompUSA, General Motors, Honeywell, Invensys, Motorola, New Power Company, Sears, Roebuck and Co., and Sun Microsystems to found the Internet Home Alliance. This alliance agreed to work together to “advance the home technology industry by developing the ecosystem to support the delivery of Internet lifestyle solutions and educating consumers on the value of an Internet lifestyle.” (See Panasonic, “Panasonic Helps found Internet Home Alliance to propel growth of Home Technology Industry,” Press Release, October 18, 2000). There are a variety of other alliances, all extremely similar to the outside observer.

³⁶ Suvendrini Kakuchi, “The House of the Future soon to open its doors,”

Technophile – Home, Smart Home,

<http://web3.asai.com.sg/timesnet/data/ab/docs/ab2200/html>, 2000;

Panasonic, “The HHI home.” *Exhibition of Dream Technologies for the 21st Century.*

<http://www.panasonic.co.jp/adv/showcase/yume/english/zone/house/index>
, 1999.

³⁷ Panasonic, The HHI Home.

³⁸ *ibid.*

³⁹ Philips Design, *la casa prossima futura* (Milan: Royal Philips Electronics, 1999).

The recent work at Philips Design has been strongly influenced by Stefano Marzano.

⁴⁰ Philips, *la casa prossima futura*.

⁴¹ Philips Design, "On-line tour of The Home of the Near Future (*la casa prossima futura*)," *The Home of the Near Future at Saks Fifth Avenue*,

<http://www.philips.com/casa>, 1999.

⁴² *ibid.*

⁴³ Barry Brummit, Brian Meyers, John Krumm, Amanda Kern, and Steven Shafer, "EasyLiving: Technologies for Intelligent Environments," Handheld and Ubiquitous Computing Conference, September 2000.

<http://www.research.microsoft.com/easyliving/publications.htm>, 2000.

⁴⁴ Brumitt, Barry and Cadiz, JJ. "Let there be Light!" Comparing Interfaces for Homes of the Future. Microsoft Research Technical Report MST-TR-2000-92, 21st September, 2000.

<http://www.research.microsoft.com/easyliving/publications.htm>, 2000.

⁴⁵ Microsoft, "The Microsoft Home in New York: Connecting Technology Room by Room. Fact Sheer. November 2000." *The Microsoft Home in New York*, www.microsoft.com/presspass/events/mshome/docs/mshomeFS.doc, 2000.

⁴⁶ Intel Architecture Labs, "Imagine the Connections..." *Intel Architecture Labs: Connected.Home*, <http://www.intel.com/ial/home/connected>, 2000; "The Connected Home," *Intel Architectures Labs: Connected.Home*, <http://www.intel.com/ial/home/connected/videoform>, 2000.

⁴⁷ On the notion of ecology see Roy A. Rapaport, *Pigs for the Ancestors: Ritual in the Ecology of a New Guinea People* (New Haven: Yale University Press, 1968); William H Durham, *Co-evolution: Genes, Culture and Human Diversity* (Stanford: Stanford University Press, 1991); Genevieve Bell, "The museum as 'cultural ecology:' a study," [Http://developer.intel.com/ial/about/museumwhitepaper](http://developer.intel.com/ial/about/museumwhitepaper), 1999; Bonni Nardi and Vicki L O'Day, *Information Ecologies: Using Technology with Heart* (Cambridge, MA: MIT Press, 2000). See also Harmeet Sawhney, "Information superhighway: metaphors as midwives," *Media, Culture and Society*, vol. 18, (1996), 291-314).

⁴⁸ Intel Architecture Labs, *The Connected Home*, 2000.

⁴⁹ Intel Architecture Lab (IAL), "Intel Architecture Labs: Enabling New Digital Experiences..." <http://developer.intel.com/ial/index>, 2000; "Research: Real People, Real Lives." <http://developer.intel.com/ial/about/research>, 2000;

Michael Mateas, Tony Salvador, Jean Scholtz, and Doug Sorenson, "Engineering

Ethnography in the Home," *Human Factors in Computing Systems: CHI '96*

Conference Proceedings, 1996; Salvador et al, *Design Ethnography*, 1999.

⁵⁰ Genevieve Bell, "Looking Across the Atlantic: Using Ethnographic Methods to Make Sense of Europe," *Intel Technical Journal*,

http://developer.intel.com/technology/itj/q32001/articles/art_1.htm, 2001.

⁵¹ Aware Home Research Initiative (AHRI), "GT's Aware Home Research Initiative," <http://www.cc.gatech.edu/fce/ahri>, 2000.

⁵² Cory D. Kidd, Robert Orr, Gregory D. Abowd, Christopher G. Atkeson, Irfan A. Essa, Blair MacIntyre, Elizabeth Mynatt, Thad E. Starner, and Wendy Newsletter, "The Aware Home: A living laboratory for ubiquitous computing research," *Proceedings of the Second International Workshop on Cooperative Buildings*, 99, 1999.

⁵³ Jane M Sanders, "Sensing the Subtleties of Everyday Life," *Research Horizons*, vol. 17, no. 2, (2000), <http://www.gtri.gatech.edu/rh-win00/index.html>, 2000.

⁵⁴ Janice Anne Costa, "Kitchen prototype design 'for lifetime,'" Kitchen & Bath Design News, KBDN.net, http://www.kitchen-bath-design.com/DESIGN-kitchens/DESIGN-UPDATE-kitchens/1999/021999_Design-Update_JCosta.asp, 1999; Rhode Island School of Design (RISD), "The Universal Kitchen," *About RISD: On View*, http://www.risd.edu/museum_exhibitions.cfm?type=past&onview=museum_onview_past_1.cfm, 1999; John Turrettini, "The kitchen of the future," *The Herald*

Sphere, 28 October 1998, www.netspace.org/herald/issues/102898/kitchen, 1998.

⁵⁵ RISD, "The Universal Kitchen."

⁵⁶ Support for the *Universal Kitchen* project came from Malcolm and Elizabeth Chance; KGK Foundation Trust; Worrell Fund; Dow Plastics; Broan – a division of Nortek; International Paper – Decorative Products Division; Masco Corporation; Schott Corporation, Technical Glass Division; Monarch Industries, Inc; Notch Design Group; Jutras Woodworking; Item Products, Inc; SUSPA Inc., Häfele America Co., Illumination Concepts; Lightollier; Fulcrum Product Development; Norman Methot Woodworking; Thomas O'Brien Woodworking; and Drama Lighting Inc. See RISD, "The Universal Kitchen."

⁵⁷ Gilbreth, *The Home-Maker and her Job*; Lupton and Miller, *The Bathroom, the Kitchen, and the Aesthetics of Waste*.

⁵⁸ John Turrettini, "The kitchen of the future."

⁵⁹ RISD, "The Universal Kitchen."

⁶⁰ Maytag Corporation, "Maytag enters into agreement with Rhode Island School of Design; Adds resources to innovation network," Press Release, <http://www.newswire.ca/releases/September1999/20/c4674.html>, 1999.

⁶¹ Ellen H. Richards, "Letter to the Massachusetts Board of the World's Fair Managers, Sears Building, Boston, 27 December, 1893," *The Rumford Kitchen: Exhibit at World's Columbian Exposition, Chicago, 1893. Excerpts from the Report of*

the Massachusetts Board of World Fair Managers, Boston, 1894.

<http://libraries.mit.edu/archives/esr/esr-rumford/html>

⁶² http://architecture.mit.edu/house_n/web/index.html

⁶³ Kent Larson, "House_n Living Laboratory," *House_n: The MIT Home of the Future*, School of Architecture and Planning, MIT,

http://www.architecture.mit.edu/house_n, 2001.

⁶⁴ Daren Fonda, "A house called HAL," *The Boston Globe Magazine*, 5 December 1999.

⁶⁵ Counter Intelligence, "MIT Media Lab. Counter Intelligence Group,"

<http://media.mit.edu/ci>, 2000.

⁶⁶ Wendy Ju, Camilo Guaqueta, Becky Hurwitz, Tilke Judd and Bonny Lee,

"counterACTIVE." *MIT Media Lab, Counter Intelligence Group*,

<http://www.media.mit.edu/ci/projects/counter>, 2000; Wendy Ju, Rebecca

Hurwitz, Tilke Judd and Bonny Lee, "counterActive: an interactive cookbook for the Kitchen counter," *Human Factors In Computing Systems: CHI '01 Conference Proceedings*, 2001.

⁶⁷ Bell, "Looking Across the Atlantic."

⁶⁸ Ray Oldenburg's work on "third places," or those "distinctive informal gathering places ... [that] represent fundamental institutions of mediation between the individual and the larger society" provides one useful way of articulating these relationships between home and the rest of the world. See Ray

Oldenburg, *The Great Good Place: Cafes, Coffee shops, Bookstores, Bars, Hair Salons, and Other Hangouts at the Heart of a Community* (New York: Marlowe and Co, 1999), xxviii.

⁶⁹ All names have been changed.

⁷⁰ Many German women have such baskets; they are an important way of understanding food and meal preparation in Germany (and elsewhere in western Europe). These baskets suggest a way of consuming food that is local and bought daily; they are not the shopping carts of America with the attendant freeways, supermarkets, large freezers and large cars.

⁷¹ Most high schools in France have an extended two-hour lunch break, with the expectation that children will go home and eat. Even if they remain at school, the notion is that meals should not be rushed.

⁷² See Donna Birdwell-Pheasant and Denise Lawrence-Zúñiga, eds., *House Life: Space, Place and Family in Europe* (Oxford: Berg, 1999); Irene Cieraad, ed., *At Home: An Anthropology of Domestic Space* (New York: Syracuse University Press, 1999). See also Attfield, "Bringing Modernity Home," 1999; Moira Munro and Ruth Madigan, "Negotiating space in the family home," in Cieraad, *At Home: An Anthropology of Domestic Space*, 107-117; Tim Putnam, "'Postmodern' Home Life," in Cieraad, *At Home: An Anthropology of Domestic Space*, 144-152; Elizabeth Shove, "Constructing Home: A Crossroad of Choices," in Cieraad, *At Home: An Anthropology of Domestic Space*, 130-143.

⁷³ Gilbreth, *The Home-maker and her Job*, 158.

⁷⁴ Within anthropology, there is a long history of thinking about, documenting practices around, and theorizing food. More recent works have considered the ways in which food is mobilized as a way of talking about and constructing particular national or ethnic identities, as well as creating or negotiating global ones. (See Daniel Bell & G Valentine, *Consuming Geographies: We are where we eat* (London: Routledge, 1997); Carole Counihan, and Penny Van Esterik, eds. *Food and Culture: A Reader* (New York: Routledge, 1997); Lynn Harbottle, "'Bastard' chicken, or *ghormeh-sabzi*? Iranian women guarding the health of the migrant family," In Stephen Edgell, K. Hetherington and Alan Warde, eds., *Consumption Matters: The Production and Experience of Consumption* (London: Blackwell Publishers, 1996), 204-226; Gordon Mathews, *Global Culture/Individual Identity: Searching for Home in the Cultural Supermarket* (London: Routledge, 2000.)).

Feminist scholars have written about the ways in which food figures in narratives of gender and the body, particularly as a site of resistance and power, such as the extensive body of critical literature on anorexia. See Joanne Hollows, "The Bachelor Dinner: Masculinity, Domesticity and Food Practices in *Playboy*, 1953-1963," *Cultural Aspects of Food. Food Resources*, Oregon State University, www.orst.edu/food-resources/kelsey/hollows, 2000; Wendy Varney, "The Briar around the strawberry patch: toys, women and food," *Women's Studies International Forum*, vol. 19, no, 3, (1996), 267-276; Carole Counihan, *The*

Anthropology of Food and Body: Gender, Meaning and Power (London-New York: Routledge, 1999).

⁷⁵ Roald Dahl, *Charlie and the Chocolate Factory* (New York: Alfred Knopf, 1964).

⁷⁶ Jofish Kaye and Paul Thordarson, "Robocrop," *MIT Media Lab, Counter Intelligence Group*, <http://www.media.mit.edu/ci/projects/robocrop>, 2000.

⁷⁷ Joseph Kaye and Niko Matsakis, "Mr. Java," *IEEE Computer Graphics and Applications*, May 2000.

⁷⁸ Kaye, *Symbolic Olfactory Display*.

⁷⁹ See GH Hofmeester, JAM Kemp, and ACM Blankendaal, "Sensuality in Product Design: a structured approach," *Conference proceedings on Human Factors in Computing Systems* (1996), 428-435; Bonni Nardi and Vicki L O'Day, *Information Ecologies: Using Technology with Heart*; Rosalind Picard, *Affective Computing* (Cambridge, MA: MIT Press, 2000).

⁸⁰ Philips Design, *la casa prossima futura*, 26-27.