Design and the Elastic Mind

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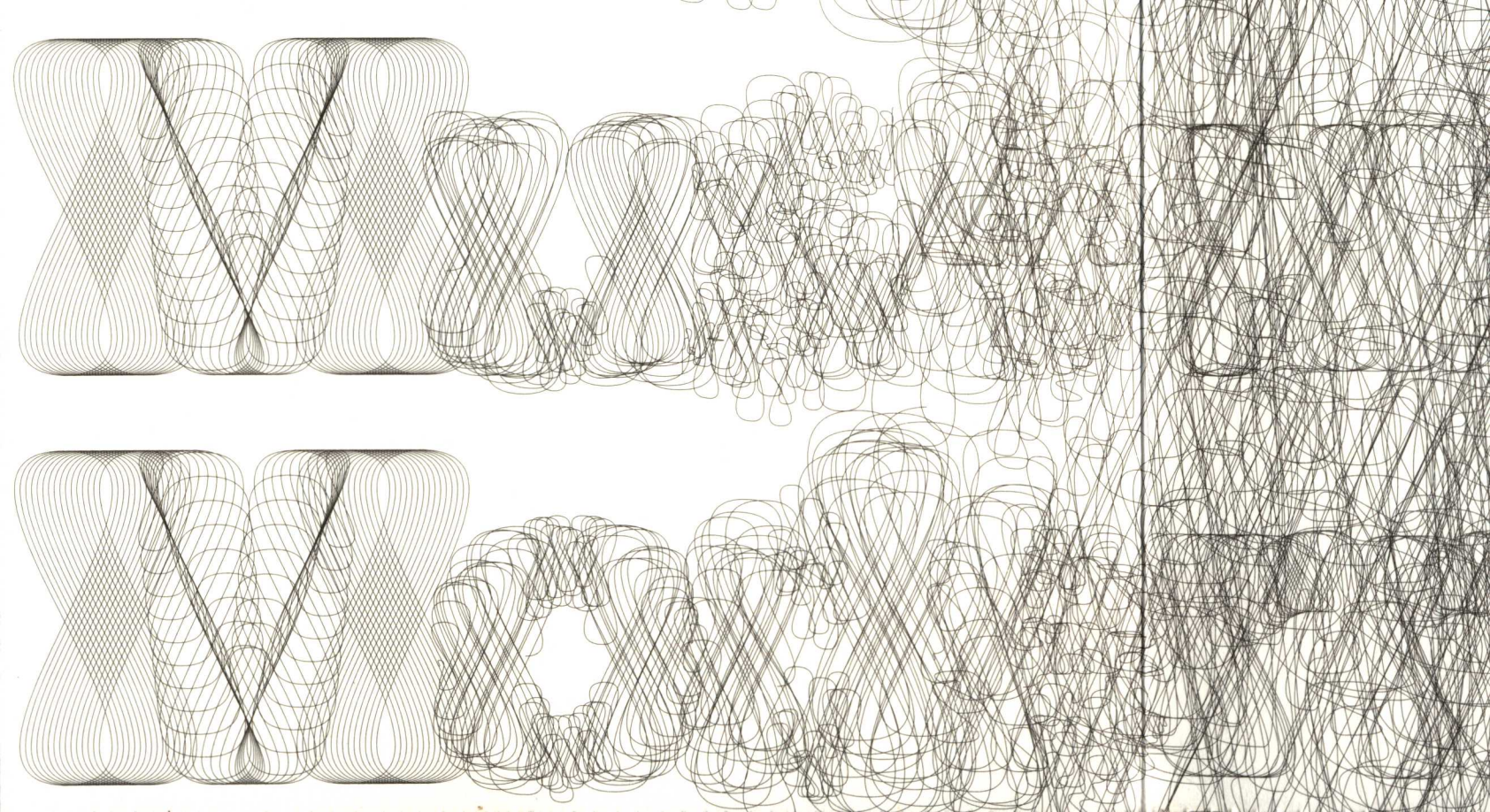

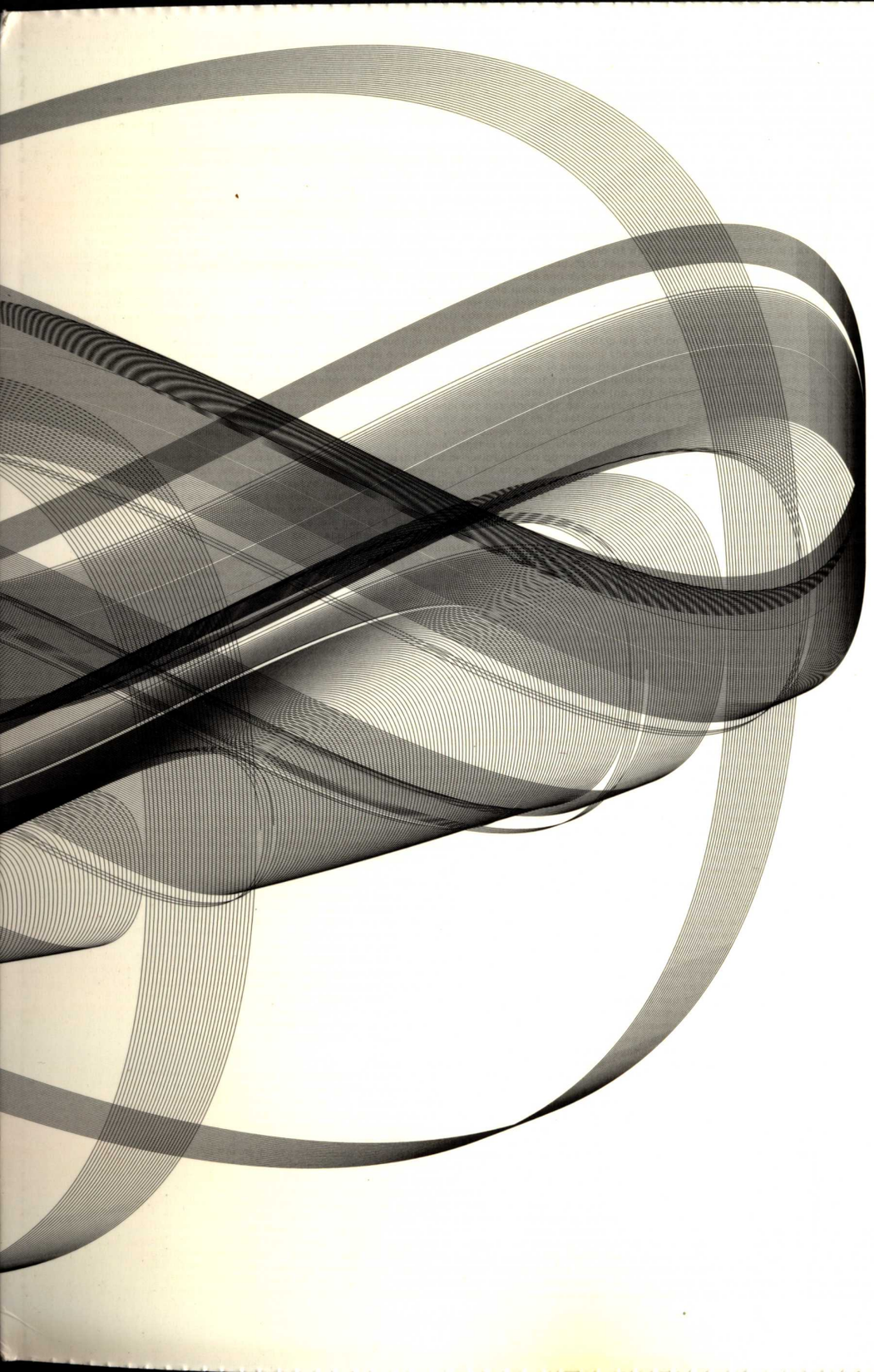

Design and the Elastic Mind

The Museum of Modern Art, New York

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Foreword

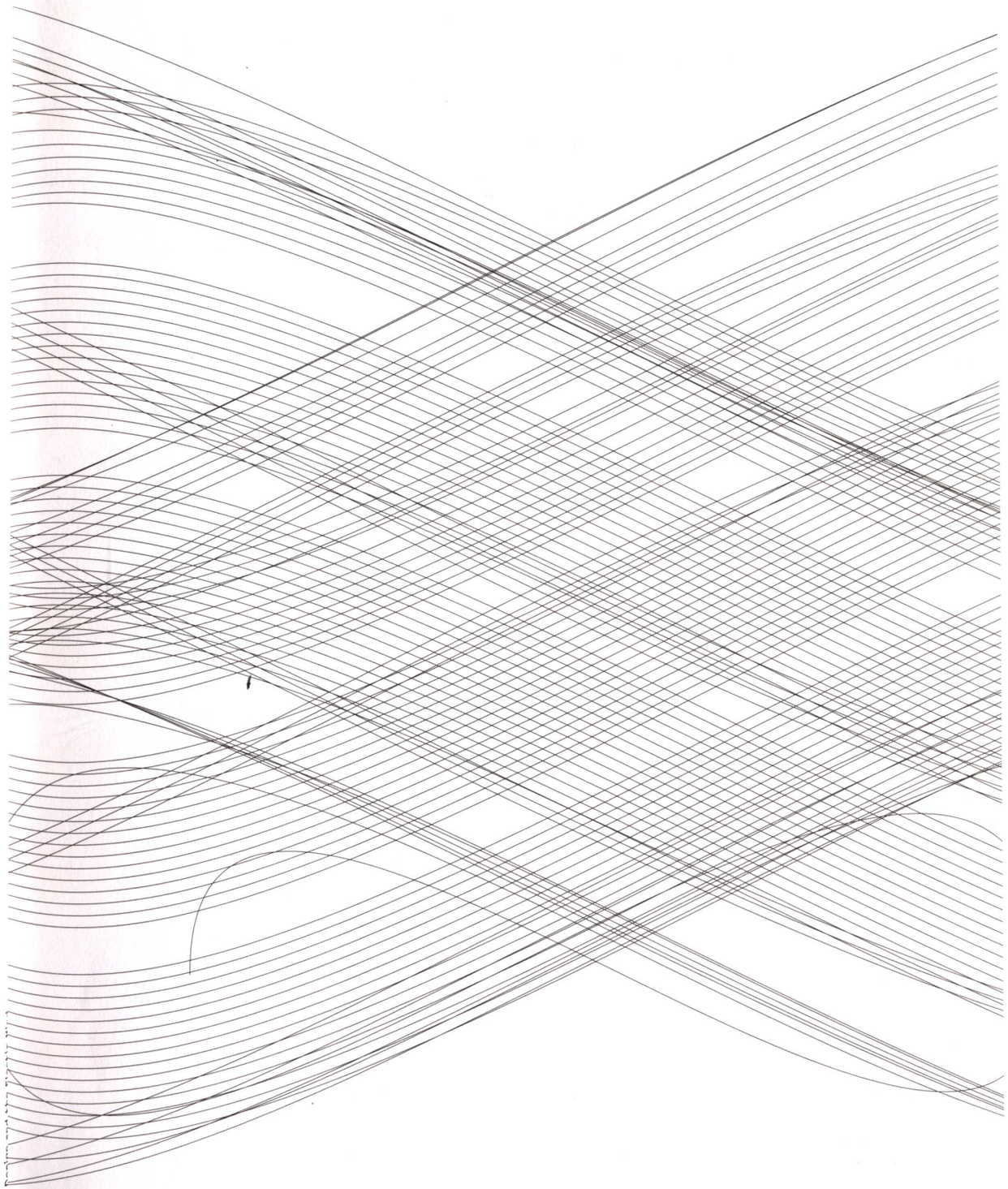
With Design and the Elastic Mind, The Museum of Modern Art once again ventures into the field of experimental design, where innovation, functionality, aesthetics, and a deep knowledge of the human condition combine to create outstanding artifacts. MoMA has always been an advocate of design as the foremost example of modern art's ability to permeate everyday life, and several exhibitions in the history of the Museum have attempted to define major shifts in culture and behavior as represented by the objects that facilitate and signify them. Shows like Italy: The New Domestic Landscape (1972), Designs for Independent Living (1988), Mutant Materials in Contemporary Design (1995), and Workspheres (2001), to name just a few, highlighted one of design's most fundamental roles: the translation of scientific and technological revolutions into approachable objects that change people's lives and, as a consequence, the world. Design is a bridge between the abstraction of research and the tangible requirements of real life.

The state of design is strong. In this era of fast-paced innovation, designers are becoming more and more integral to the evolution of society, and design has become a paragon for a constructive and effective synthesis of thought and action. Indeed, in the past few decades, people have coped with dramatic changes in several long-standing relationships—for instance, with time, space, information, and individuality. We must contend with abrupt changes in scale, distance, and pace, and our minds and bodies need to adapt to acquire the elasticity necessary to synthesize such abundance. Designers have contributed thoughtful concepts that can provide guidance and ease as science and technology proceed in their evolution. Design not only greatly benefits business, by adding value to its products, but it also influences policy and research without ever reneging its poietic, nonideological nature—and without renouncing beauty, efficiency, vision, and sensibility, the traits that MoMA curators have privileged in selecting examples for exhibition and for the Museum's collection.

Design and the Elastic Mind celebrates creators from all over the globe—their visions, dreams, and admonitions. It comprises more than two hundred design objects and concepts that marry the most advanced scientific research with the most attentive consideration of human limitations, habits, and aspirations. The objects range from

nanodevices to vehicles, from appliances to interfaces, and from pragmatic solutions for everyday use to provocative ideas meant to influence our future choices. Organized by Paola Antonelli, Senior Curator, Department of Architecture and Design, and Patricia Juncosa Vecchierini, Curatorial Assistant, this exhibition reaffirms the Museum's engagement with contemporary design practice and its ongoing reflection on the future responsibilities of design.

Glenn D. Lowry
Director, The Museum of Modern Art



Preface

Design and the Elastic Mind explores the explosively reciprocal relationship between science and design in the contemporary world. After a generation of postmodern styling in which design seemed more related to the techniques of marketing than to the horizons of new knowledge, this exhibition brings together a truly impressive range of current practices, reflecting a mutual interchange that is almost without precedent. Of course, at least since the scientific revolution of the sixteenth and seventeenth centuries, design and science have been intertwined in a way first dreamed of by Leonardo da Vinci. By the time of Francis Bacon and Galileo, design was serving as the handmaiden to laboratory experimentation, which itself was key to the new scientific knowledge, based in observation. Design and science first aligned in making invisible harmonies and mechanics visible. Objects were conceived both as instruments to lay bare nature's secrets and as concrete representations of that newfound knowledge. As this knowledge ever-increasingly surpassed the physical realm of everyday perception, design came to reflect the underlying structures and patterns of nature, as seen through magnification first by telescope, then by microscope, and later by new types of photography, such as X-rays and the like. All of these had a dramatic impact on artistic practices, and also on design.

In recent years the threshold of perception has transcended the visual altogether. Medicine has developed techniques for imaging phenomena that do not have a visual manifestation, and natural phenomena are recorded in abstract patterns that have no counterparts in the observable world. Design, too, deals increasingly with a wider spectrum of the senses. It is vital to the creation of the physical forms and representations that allow research to be communicated, expanded, and, ultimately, applied.

Continuing an investigation she began in 2002 with the exhibition and catalogue SAFE: Design Takes On Risk, in Design and the Elastic Mind Paola Antonelli addresses the role of design in a world in which humans have surpassed their Enlightenment roles as neutral observers and have become actors on the very forces of nature. While the show's viewpoint is largely optimistic, embracing science and design as agents of progress, there is also a clear undertone of urgency. Together, design and science must deal with the consequences of our ability to engineer natural phenomena. In the wake of the 2007 Global Environment Outlook report of the United Nations Environment Program, the urgency is no longer anecdotal.

The prescience of this book and of the exhibition it accompanies—and, indeed, of the works, themselves—lies in the recognition of a very concrete trend. The blurring of boundaries between the real and the virtual and our ever-increasing reliance on advanced

technology in everyday life have prompted designers to look to the languages and processes of today's mutating sciences. At the same time, scientists have discovered that design can help them master complexity and take advantage of the new building blocks provided by nanotechnology, for instance. Design and the Elastic Mind is not concerned only with designers who have an interest in the latest scientific achievements, but also with scientists who are (unconsciously or otherwise) engaged in the act of design.

The emphasis on scale in design, from the dazzlingly large to the infinitesimally small, has its antecedents in the influential 1968 film Powers of Ten, by Charles and Ray Eames. That seminal film, created during the period of the Cold War, demonstrates an incredibly contemporary concern. As in the Cold War era, in today's political and scientific climate huge technological and scientific advances are underway and new behaviors are projected and celebrated. As then, we are gripped by the anxiety that accompanies rapid change, from the Internet's profound restructuring of our everyday lives to our capacity to map the human genome, while we simultaneously engage in astoundingly hopeful explorations of both aesthetics and technology. It is the elastic mind—with the flexibility and strength to embrace progress and to harness it—that is best suited to confront this world of seemingly limitless challenges and possibilities.

Design and the Elastic Mind explores the changing scales of experiment in contemporary design and science, recalibrating design and its role in the shaping of experience.

Barry Bergdoll
Philip Johnson Chief Curator of
Architecture and Design

Ben Fry (American, born 1975)
Aesthetics + Computation Group (est. 1996),
MIT Media Laboratory (USA, est. 1980)
Genomic Cartography: Chromosome 21. 2001
Processing software

Design and the Elastic Mind

Paola Antonelli

History is punctuated by uproariously wrong predictions made by savvy individuals blindsided by progress: Ferdinand Foch, Marshal of France in the early part of the twentieth century, stated in 1911 that airplanes were interesting toys of no use for the military; movie producer Darryl F. Zanuck forecast in 1946 the demise of television; and Ken Olsen, of Digital Equipment Corporation, dismissed in 1977 the idea that anyone would want to keep a computer at home. Revolutions are not easy on us, especially when they occur as rapidly and as frequently as they have in the past 150 years. A few exceptional individuals are already wired for change, and the masses have a tendency to either admire them as visionaries or burn them at the stake as witches and heretics. However, these individuals do not represent the majority. In order to step boldly into the future, the majority needs design.

Adaptability is an ancestral distinction of human intelligence, but today's instant variations in rhythm call for something stronger: elasticity. The by-product of adaptability + acceleration, elasticity is the ability to negotiate change and innovation without letting them interfere excessively with one's own rhythms and goals. It means being able to embrace progress, understanding how to make it our own. One of design's most fundamental tasks is to help people deal with change. Designers stand between revolutions and everyday life. They study and appreciate

people's strengths and insecurities, their need for easy access to objects and systems and their cautiously adventurous wishes—a little frisson a day is acceptable but anything more becomes overwhelming. Designers have the ability to grasp momentous changes in technology, science, and social mores and to convert them into objects and ideas that people can understand and use. Without designers, instead of a virtual city of home pages with windows, doors, buttons, and links, the Internet would still be a series of obscure strings of code,[1] all cars would look like technologically updated Model Ts, and appliances would be reduced to standardized skeletons. Without a visual design translation, many fundamental concepts—such as the scope of the human genome or its comparison with that of other primates (see p. 142)—would remain ungraspable by most. Designers give life and voice to objects, and along the way they manifest our visions and aspirations for the future, even those we do not yet know we have.

Each new technological era brings its own malady, a sense of displacement that inevitably accompanies innovation—that is why innovation is often disruptive. Like East Germans after the fall of the Berlin Wall, some feel nostalgia for a more comfortable, albeit less progressive, past. Let's count today's disruptions: We routinely live at different scales, in different contexts, and at different settings—Default, Phone-only, Avatar On, Everything Off—on a number of screens, each with its own size, interface, and resolution, and across several time zones. We change pace often, make contact with diverse groups and individuals,

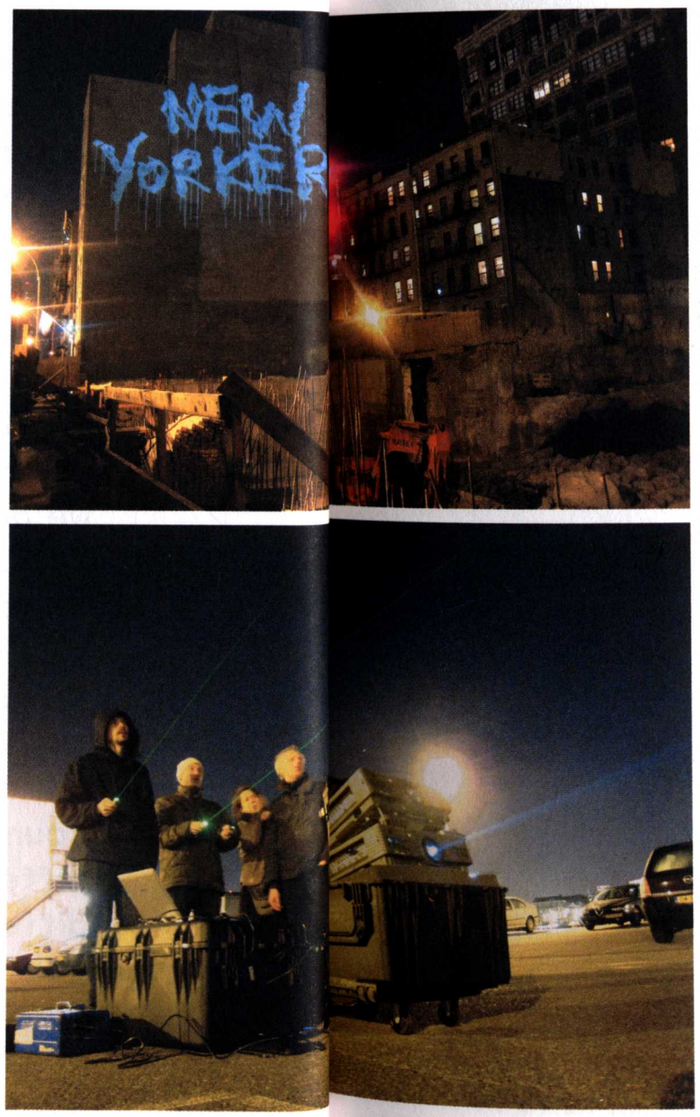
sometimes for hours, other times for minutes, using means of communication ranging from the most encrypted and syncopated to the most discursive and old-fashioned, such as talking face-to-face—or better, since even this could happen virtually, let's say nose-to-nose, at least until smells are translated into digital code and transferred to remote stations. We isolate ourselves in the middle of crowds within individual bubbles of technology, or sit alone at our computers to tune into communities of like-minded souls or to access information about esoteric topics.

Over the past twenty-five years, under the influence of such milestones as the introduction of the personal computer, the Internet, and wireless technology, we have experienced dramatic changes in several mainstays of our existence, especially our rapport with time, space, the physical nature of objects, and our own essence as individuals. In order to embrace these new degrees of freedom, whole categories of products and services have been born, from the first clocks with mechanical time-zone crowns to the most recent devices that use the Global Positioning System (GPS) to automatically update the time the moment you enter a new zone. Our options when it comes to the purchase of such products and services have multiplied, often with an emphasis on speed and automation (so much so that good old-fashioned cash and personalized transactions—the option of talking to a real person—now carry the cachet of luxury). Our mobility has increased along with our ability to communicate, and so has our capacity to influence the market with direct feedback, making us all into arbiters and opinion makers. Our idea of privacy and private property has evolved in unexpected ways, opening the door

top: James Powderly, Evan Roth, Theo Watson, and HELL. Graffiti Research Lab. **L.A.S.E.R. Tag.** Prototype. 2007. 60 mW green laser, digital projector, camera, and custom GNU software (L.A.S.E.R. Tag V1.0, using OpenFrameworks)

New forms of communication transcend scale and express a yearning to share opinions and information. This project simulates writing on a building. A camera tracks the beam painter of a laser pointer and software transmits the action to a very powerful projector.

bottom: James Powderly, Evan Roth, Theo Watson, DASK, FOXY LADY, and BENNETT4SENATE. Graffiti Research Lab. **L.A.S.E.R. Tag graffiti projection system.** Prototype. 2007. 60 mW green laser, digital projector, camera, custom GNU software (L.A.S.E.R. Tag V1.0, using OpenFrameworks), and mobile broadcast unit



for debates ranging from the value of copyright to the fear of ubiquitous surveillance.[2] Software glitches aside, we are free to journey through virtual-world platforms on the Internet. In fact, for the youngest users there is almost no difference between the world contained in the computer screen and real life, to the point that some digital metaphors, like video games, can travel backward into the physical world: At least one company, called area/code, stages "video" games on a large scale, in which real people in the roles of, say, Pac Man play out the games on city streets using mobile phones and other devices.

Design and the Elastic Mind considers these changes in behavior and need. It highlights current examples of successful design translations of disruptive scientific and technological innovations, and reflects on how the figure of the designer is changing from form giver to fundamental interpreter of an extraordinarily dynamic reality. Leading up to this volume and exhibition, in the fall of 2006 The Museum of Modern Art and the science publication Seed launched a monthly salon to bring together scientists, designers, and architects to present their work and ideas to each other. Among them were Benjamin Aranda and Chris Lasch, whose presentation immediately following such a giant of the history of science as Benoit Mandelbrot was nothing short of heroic, science photographer Felice Frankel, physicist Keith Schwab, and computational design innovator Ben Fry, to name just a few.[3] Indeed, many of the designers featured in this book are engaged in exchanges with scientists, including Michael Burton and Christopher Woebken, whose work is influenced by nanophysicist Richard A. L. Jones; Elio Caccavale, whose interlocutor is Armand Marie Leroi, a biologist from the Imperial

College in London; and the designers from Loop.pH, who are working on a project with John Walker, the winner of the 1997 Nobel Prize for Chemistry.[4]

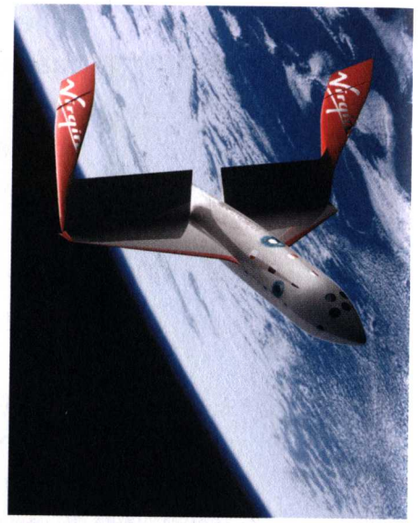
As Hugh Aldersey-Williams discusses in his essay in this volume, the exploration of the promising relationship between science and design is of particular relevance. While technology still traditionally acts as the interface, the conversation between design and science has become more direct and focused. What the computer has done for designers, the nanoscale is doing for scientists: It is giving them a whole new taste of the power of unobstructed design and manufacture. In an outstanding essay in the 2006 book Sensorium: Embodied Experience, Technology, and Contemporary Art, Peter Galison introduces the concept of "nanofacture": "Nanoscientists want to know what devices they can make....In the halls of 'pure' science, such a pragmatic stance toward the real is still relatively new. Indeed, it is an extraordinary and extraordinarily disturbing alteration of the practice of research, and in the very self-definition of what it means to be a scientist."[5] Scientists Thomas G. Mason and Carlos J. Hernandez, architecture firm Aranda/Lasch, nanotechnologist Paul W. K. Rothemund, and designer James King are examples of those engaging in an embryonic dialogue between design and science that is bound to change the world.

Fundamental to this dialogue is the appreciation of the role of scale in contemporary life. Two essays, the first by nanophysicist Ted Sargent and the second by visualization design expert Peter Hall, describe the ways in which scientists and designers tackle the extremely small and the extremely large in order to bring them to a human scale. Last comes my own essay about scale, albeit of the social kind, which discusses the remarkable new relationship between the individual and the collective sphere and the effects it is having on the theory and practice of our built environment.

All of these essays are accompanied by examples

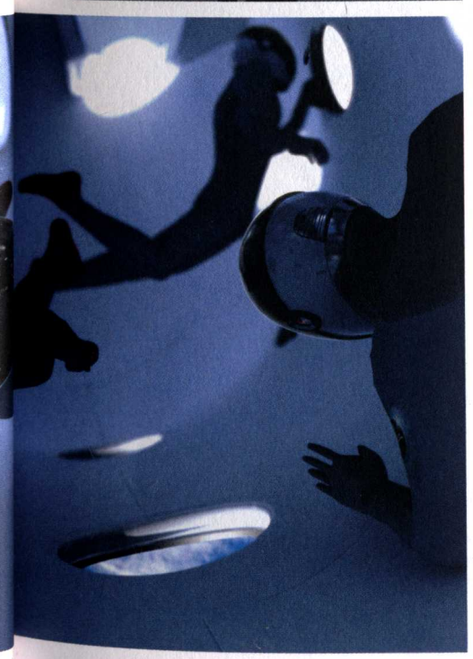
below and bottom: Dick Powell and Richard Smith. Seymourpowell. **SpaceShipTwo: Interior for Virgin Galactic Spaceship.** Concept. 2006

Steamships, trains, telephones, and airplanes changed our sense of scale and our rapport with time and space. Suborbital flight will soon push us even farther.



19 Johan Liden and aruliden. **Motorola Sparrow RFID (Radio Frequency Identification) scanning device.** Concept. 2006–ongoing. Injection-molded plastic, glass, and aluminum, 2 3/4 × 2 3/4 × 1/2" (7 × 7 × 103 cm)

The time has come to take control of the dozens of features available for portable devices. Getting more information on the surrounding context—whether commercial, cultural, or geographic—is a function that will presumably become more and more important.



of singular design creativity that introduce new areas of study and influence as well as the new types of functional gradients that designers are trying to endow objects with, taking their cues from sources as varied as nanostructures, biological systems, topography, and cosmology. The goal is to facilitate as seamless a movement as possible from fast to slow, virtual to physical, cerebral to sensual, automatic to manual, dynamic to static, mass to niche, global to local, organic to inorganic, and proprietary to common, to mention just a few extreme couplings. Some examples are by bona fide designers, others by scientists and artists who have turned to design to give method to their productive tinkering, what John Seely Brown has called "thinkering."[6] They all belong to a new culture in which experimentation is guided by engagement with the world and open, constructive collaboration with colleagues and other specialists.

Design 1:1

Today, many designers have turned several late twentieth-century infatuations on their heads, for instance with speed, dematerialization, miniaturization, and a romantic and exaggerated formal expression of complexity. After all, there is a limit beyond which micro-keyboards are too small for a person's fingers and complexity simply becomes too overwhelming. Examples abound in all fields of people's desire to return to what is perceived as a human dimension, including gastronomy (the Slow Food movement), agriculture (organic produce), travel (ecotourism), production of energy (distributed generation), economic aid (microinvestment), and politics (the town hall meeting), to name just a few.[7] These all revolve around the idea that global issues should be tackled bottom-up and that an individual or local spark can start a powerful chain reaction with global implications.

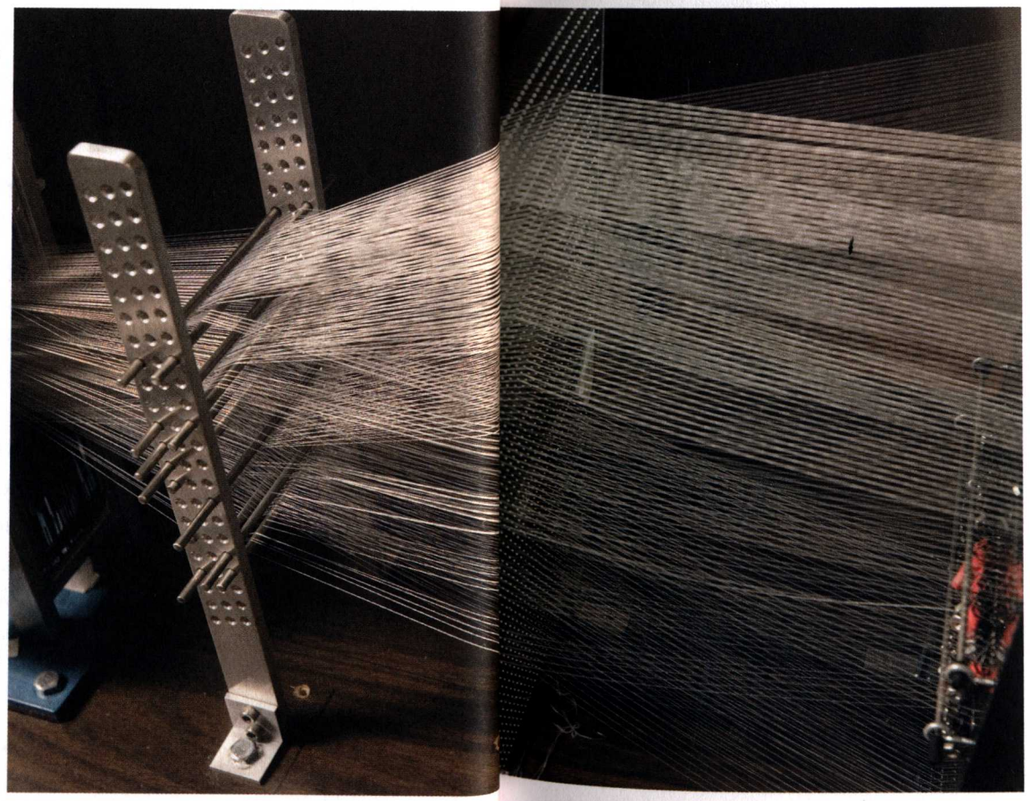
The most contemporary of design theory is devoted to the quest for an environment, whether virtual

or physical, built in human proportion—much the way in architecture a hypothetical 1:1 model would represent buildings as life size. Designers who believe in this preach simplicity, and they labor to give objects souls and personality and to ease their communication with people and with other objects.[8] They apply the same bottom-up methodology to spawn innovations that are organically attuned to human nature and to the world, and they rework priorities so that human beings always come before any celebration of progress, as in the project One Laptop per Child or in Jonathan Harris's moving Internet interface We Feel Fine. These designers domesticate innovation and make sure that objects will deliver value and meaning and therefore justify their presence in people's lives, as with Mathieu Lehanneur's delicately high-tech Elements. And out of consideration for people's well-being, they help us incorporate healthy behaviors within our frenetic habits, as seen in Marie-Virginie Berbet's Narco office capsule.

The idea of human scale has changed since Charles and Ray Eames's famous 1968 film Powers of Ten because human perception has been expanded and augmented by technology. Distance is not what it used to be, and neither is time: Not only does it range from the attosecond (10^{-18} seconds, or the time it takes for light to travel the length of three hydrogen atoms) to the Long Now, the concept that inspired Danny Hillis to establish a foundation whose goal is to promote thinking for the next ten thousand years,[9] but some professionals' routine commute is a twice-a-month Tokyo–New York round-trip while others work across several time zones without a need to state their position at any time. Indeed, where and when have become hard to pin down on any who.[10] There is a standoff between the two ancient Greek notions of time: chronos, the shared convention of sequential time marked by the sundial, and kairos, the subjective moment that allows an individual to adapt and evolve with circumstances. While no one would argue that we are beholden to the former, the shift toward the latter is seen in the urge to record and share personal, life-defining moments that is at the source of the proliferation

Farshid Guilak and Franklin Moutos. Orthopaedic Bioengineering Laboratory, Duke University School of Medicine. **3-D woven scaffolds for tissue regeneration.** 2001–07. Poly(glycolic acid) fibers or poly(e-caprolactone) fibers, woven fiber scaffold: 1 1/8 × 11 3/4 × 1/32" (3 × 30 × 0.1 cm); weaving machine: 23 5/8 × 39 3/8 × 39 3/8" (60 × 100 × 100 cm)

Scientists study textile weaving and other crafts techniques in order to better design and perform their experiments.



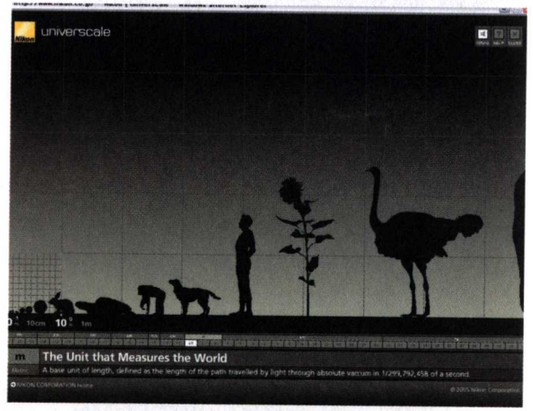
of Weblogs and other tagged and mapped metadiaries. This obsessive chronicling of personal information online—from pets' names to breakfast preferences, the phenomenon of over-sharing is frequent and is the subject of several etiquette-themed discussions—points to people's attempts to share their epiphanies and impose their own individual experiences of time, memory, and life over the global network that runs on conventional time. Counting on extraordinary advances in data storage capacity and on new, easy-to-use software, we can finally sit back and remember everything.[11] From the revelation that women do not need to have menstrual periods to studies whose goal is to dramatically reduce the amount of sleep needed in order to be perfectly functional and even the debate on human lifespan—which some say soon could be stretched at least half again as long as current expectations—the focus now is on ways to break the temporal rhythms imposed by society in order to customize and personalize them.

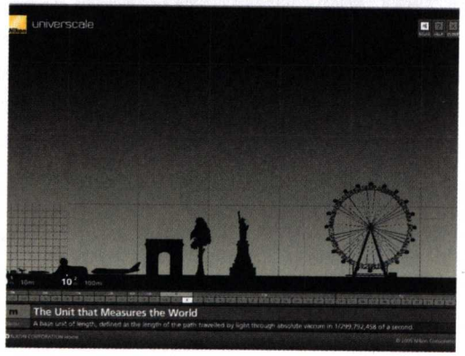
If design is to help enable us to live to the fullest while taking advantage of all the possibilities provided by contemporary technology, designers need to make both people and objects perfectly elastic. It will entail some imaginative thinking—not simply following a straight line from A to C passing through B. Several design principles can be used to accomplish this. One recurrent theme in design today is a stronger involvement of the senses to both enhance and integrate the delivery of high-tech functions, as in James Auger and Jimmy Loizeau's and Susana Soares's scent-based projects or in the synesthesia-inspired work of Eyal Burstein and Michele Gauler—both of which demonstrate technology's ability to deepen our sensorial awareness and spectrum.[12] Similarly, an appeal to people's sense of identity and place can be found in many projects included here, such as in the bioengineering of "love moles" and "bone rings," or in those that address memory in a literal way, such as Michele Gauler's Digital Remains.

Design schools like the Academy of Art and Design in Eindhoven, The Netherlands (offering, for instance, postgraduate courses in Humanitarian Design and Sustainable Style and Interior, Industrial, and

Identity Design), or the Royal College of Art, London, focus their courses on senses and sensuality, identity, memory, and on other staples of human life that are as old as humankind—birth, death, love, safety, and curiosity—yet are rendered urgent by the speed with which technology is moving. These principles differ from the so-called human-centered design that functionalist industrial designers of the past fifty years have employed to shift their attention from the object to the "user";[13] they are reminders of the great responsibility that comes with design's new great power of giving form and meaning to the degrees of freedom opened by the progress of technology. Such a holistic approach calls for the development of well-honed analytical and critical muscles and for a new, self-assured theory of design. At the Royal College of Art, for instance, Anthony Dunne, head of the Design Interactions Department, preaches the importance of "critical design," which he defines as "a way of using design as a medium to challenge narrow assumptions, preconceptions, and givens about the role products play in everyday life."[14] "Design for Debate," as this new type of practice is also called, does not always immediately lead to "useful" objects but rather to servings of exotic food for thought whose usefulness is revealed by their capacity to help us ponder how we really want our things to fit into our lives. Noam Toran's Accessories for Lonely Men and IDEO's Social Mobiles comment on, respectively, solitude and the need for a new etiquette in the age of wireless communication. And we certainly need such meditation more than we need another mobile phone design.

Indeed, even as technology offers us more and more options, many agree that we in fact require fewer—not more—objects in our lives. This very simple belief unites the diverse and yet similarly idealistic efforts of many designers worldwide who are trying to inform our lives with the same economy of energy and materials as found in nature. In addition to balancing our lives with the imperatives of new technology, designers today must also consider the impact of their creations on the environment. Organic design has had many different connotations in history, but in its most contemporary meaning it encompasses not only the enthusiastic exploration of natural forms and structures but also interpretations of nature's





Business Architects Inc. for Nikon Corporation. **Universcale, Web application describing the size of things in the universe.** 2005. Illustrator, Photoshop, Flash, and VxEditor software

Charles and Ray Eames's 1968 film Powers of Ten was particularly representative of scale as related to the human dimension. New applications relying on updated technologies attempt the same feat.

economical frameworks and systems. It emerges from the rapidly growing realization that we need to learn to use less matter and energy and to be more efficient. Several factors make contemporary organic design radically different from its past expressions. Towering among these is the computer, whose capacity to master complexity has, perhaps surprisingly, allowed a closeness to the forms and structures of nature never achieved before. Moreover, the urgent need to manage nature's resources more thoughtfully and economically has provoked a sense of responsibility that is felt—or at least worn as a badge—by contemporary thinkers and doers. This trend can be seen in the pervasive use of the term DNA and the suffix -scape to describe any kind of organically integrated context (e.g., "homescape") and of biologically inspired attributes, such as "cellular," to describe the organic skeleton of such entities as the organization of new religious sects, lighting systems, and buildings. Even "viral" has taken on a positive meaning by indicating successful infectious and self-replicating design and communication phenomena.

When it comes to design, however, a badge is not enough: According to an annual review by Britain's Design Council, eighty percent of the environmental impact of the products, services, and infrastructures around us is determined at the design stage.[15] Design needs to engage directly and develop further some of the tools it is currently experimenting with, such as biomimicry,[16] algorithms and other forms of computational design, and nanotechnology. Nanotechnology, in particular, offers the promise of the principle of self-assembly and self-organization that one can find in cells, molecules, and galaxies; the idea that you would need only to give the components of an object a little push for the object to come together and reorganize in different configurations could have profound implications for the environment, including energy and material savings. "In nanotechnology, new materials and structures can be built atom-by-atom or molecule-by-molecule," explains the introduction to the course "Nano and Design" taught by engineer extraordinaire Cecil Balmond at the University of Pennsylvania, while algorithms are described by architects Chris Lasch and Benjamin Aranda as "a macro, a series of steps, a recipe for making bread." In the blog that complements his book Soft Machines, Richard Jones extols the potential of nanotechnology

in several areas, among them medicine, and talks about "persuading...cells to differentiate, to take up the specialized form of a particular organ," listing several reasons why nanotechnology would be beneficial to a sustainable energy economy.[17]

All these tools are about giving objects basic yet precise instructions and letting them fully develop and connect in networks and systems, and this is where one of the most powerful new directions for design lies. While traditional design is often about cutting existing materials to shape or, in the best cases, taming and adapting them, computational design and nanodesign are about generating objects, as can be seen in embryonic and conceptual examples such as Christopher Woebken's New Sensual Interfaces, and also about seeing them adapt to different circumstances, as in Chuck Hoberman's Emergent Surface responsive architecture.

As they advocate and obtain roles that are more and more integral to the evolution of society, designers find themselves at the center of an extraordinary wave of cross-pollination. Design-centered interdisciplinary conferences have existed for decades,[18] traditionally initiated by designers. Only recently have other communities started to seek designers' contributions, but this is only the beginning. To adapt and master new technologies and directions, design has branched out into dozens of specialized applications, from communication to interaction and from product design to biomimicry. On the other hand, in order to be truly effective, designers should dabble in economics, anthropology, bioengineering, religion, and cognitive sciences, to mention just a few of the subjects they need today in order to be well-rounded agents of change. Because of their role as intermediaries between research and production, they often act as the main interpreters in interdisciplinary teams, called upon not only to conceive objects, but also to devise scenarios and strategies. To cope with this responsibility, designers should set the foundations for a strong theory of design—something that is today still missing—and become astute generalists. At that point, they will be in a unique position to become the repositories of contemporary culture's need for analysis and synthesis, society's new pragmatic intellectuals. Like stones thrown in a large pond, we hope that the ideas advanced in this book will make waves, and that the waves will ripple into an irresistible discussion on the future role and responsibility of designers.

25 Hussein Chalayan. **Mechanical dress from the One Hundred and Eleven collection.** Prototype. 2006. Digitally printed cotton, metal plates with Swarovski crystals, organza, electric mechanisms, and electronic circuits, dimensions variable. Prototype by 2D3D, UK (2006)

As a metaphor for the need to have fewer, more elastic objects in our lives, Chalayan's convertible dress could inspire nanodevices and building facades alike.

Notes

1.
Mosaic, developed by Marc Andreesen and Eric Bina for the National Center for Supercomputing Applications and released in 1993, was the World Wide Web's first popular browser. Its success was due to its clear graphic user interface, which made it approachable and easy to use.

2.
For a fuller discussion of copyright issues, see my note 5 on p. 160 of this volume.

3.
Aranda/Lasch and Mandelbrot made their presentations at the second salon, on January 8, 2007. Mandelbrot is the mathematician who gave the strongest impetus to fractal geometry by linking it to nature and transformed it into a cultural phenomenon.

4.
Jones, a professor at England's University of Sheffield's Department of Physics and Astronomy, has written several books, among them Soft Machines: Nanotechnology and Life (London: Oxford University Press, 2004). Leroi's best-known book is the influential Mutants: On the Form, Varieties and Errors of the Human Body (New York: Harper Collins, 2003).

5.
Peter Galison, "Nanofacture," in Sensorium: Embodied Experience, Technology, and Contemporary Art, ed. Caroline A. Jones (Cambridge, Mass.: MIT Press, 2006), pp. 171–73. Galison is an esteemed historian of science and physics and a professor at Harvard University.

6.
Dan E. Atkins, John Seely Brown, and Allen L. Hammond, "A Review of the OEal Resources (OER) Movement: Achievements, Challenges, and New Opportunities," Report to The William and Flora Hewlett Foundation, February 2007. OER stands for Open Educational Resources. Brown, chief scientist at Xerox until 2002 and director of the legendary Xerox Palo Alto Research Center (Xerox PARC) until 2000, is among the foremost experts on technology and innovation.

7.
The Slow Food movement was launched in Italy in 1986 to restore the pleasure of "real" food. It was so successful that it contributed to the "slow" concept now spreading to all dimensions of life, from cities to schools and even to money.

8.
Graphic designer and computer scientist John Maeda, who is also associate director of research at the MIT Media Lab, has translated his commitment to the ease of communication between people and objects into a full-fledged platform based on simplicity that involves the Media Lab as well as corporations like the Dutch electronics giant Philips. In this same vein, James Surowiecki's May 28, 2007, article in the New Yorker, titled "Feature Presentation," discusses the decline in popularity of objects encumbered by too many features, a phenomenon called "feature creep."

9.
According to its Web site, "The Long Now Foundation was established in 01996* to...become the seed of a very long-term cultural institution. The Long Now Foundation hopes to provide counterpoint to today's 'faster/cheaper' mind-set and promote 'slower/better' thinking. We hope to creatively foster responsibility in the framework of the next 10,000 years." ("*The Long Now Foundation uses five-digit dates; the extra zero is to solve the deca-millennium bug which will come into effect in about 8,000 years.")

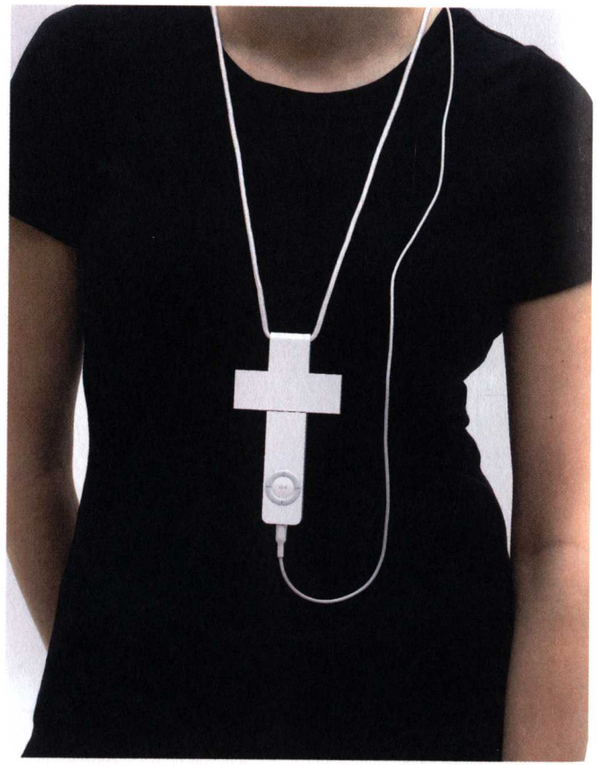
10.
When going to Dubai, make sure you bring not only your bathing suit but also your favorite ski goggles, because chances are you will visit the Snow Dome for a quick downhill race on the perfect powdery slope, in order to escape the 110-degree temperature outside; and when ordering at a McDonald's drive-thru, don't be fooled into thinking that your interlocutor is in the booth—she might be in Mumbai. The outsourcing of call centers and customer service centers has greatly contributed to the establishment of our new time-space proportion.

11.
In the May 28, 2007, issue of the New Yorker, an article by Alec Wilkinson titled "Remember This? A Project to Record Everything We Do in Life" reported that the great computer scientist Gordon Bell had in 1998 set out to digitize and archive his whole life, from childhood pictures and health records to coffee mugs. The project is still in process.

12.
Amazing things are happening in the realm of the senses. Scientists and technologists are focusing on hearing, for instance, and on its untapped potential. Several researchers are experimenting on sonocytology, a way to diagnose cancer by listening to cells—or better, by reading sonograms. Professor James K. Gimzewski and Andrew E. Pelling at the UCLA Department of Chemistry

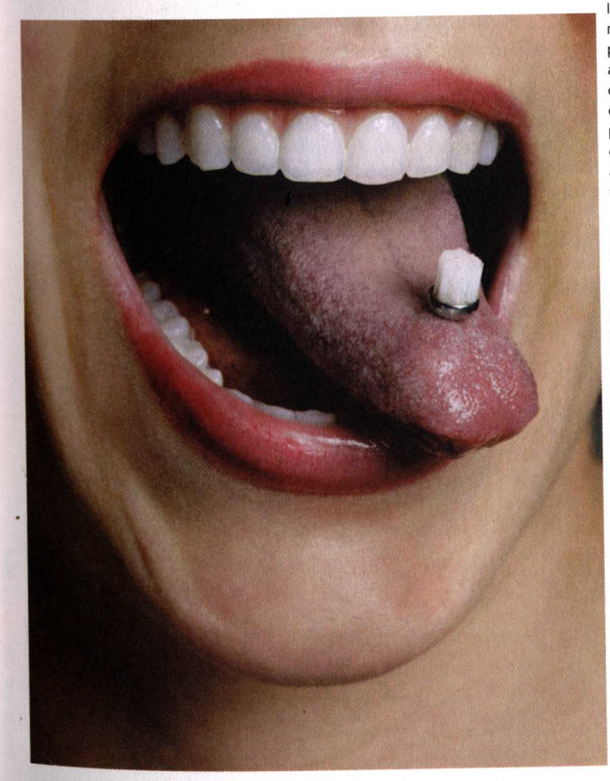
Scott Wilson. **iBelieve lanyard for iPod Shuffle.** 2005. ABS plastic, 3/8 × 4 3/4 × 3" (0.8 × 12 × 7.5 cm). Manufactured by National Electronic, China (2005)

It is an irresistible send-up of the public's fanatical adoration of Apple products and at the same time a pensive reminder of the growing importance of the spiritual sphere in a world rife with technology and ideology.



Moloudi Hadji. École cantonale d'art de Lausanne (écal). **Pierce'n Brush.** Prototype. 2003. Stainless steel and nylon, 1 1/4 × 1/4" (3.1 × 0.6 cm) diam.

Multifunctional objects for multitasking citizens of the world. Why waste the opportunity for a flexible-use tongue stud?



first made the discovery that yeast cells oscillate at the nanoscale in 2002. Amplifying this oscillation results in a sound that lies within the human audible range. As far as olfaction is concerned, one study has explored how certain dogs can sniff cancer in a person's breath (Michael McCulloch, Tadeusz Jezierski, Michael Broffman, Alan Hubbard, Kirk Turner, and Teresa Janecki, "Diagnostic Accuracy of Canine Scent Detection in Early- and Late-Stage Lung and Breast Cancers," Integrative Cancer Therapies 3 (March 2006): pp. 30–39).

13.
The champion of this attitude is renowned design critic Don Norman, whose work is directly aimed at product designers.

14.
Anthony Dunne, interview in Domus 889 (February 2006): p. 55. Moreover, the Web page introducing the college's Design Interactions Department reads: "Designers often refer to people as 'users,' or sometimes as 'consumers.' In Design Interactions, we prefer to think of both users and designers as, first and foremost, people. That is, we see ourselves as complex individuals moving through an equally complex, technologically mediated, consumer landscape. Interaction may be our medium in this department, but people are our primary subject, and people cannot be neatly defined and labeled. We are contradictory, volatile, and always surprising. To remember this is to engage fully with the complexities and challenges of both people and the field of interaction design."

15.
Design Council, Annual Review 2002, London: 2002, p. 19.

16.
As the Biomimicry.net Web site reads, "Biomimicry (from bios, meaning life, and mimesis, meaning to imitate) is a design discipline that studies nature's best ideas and then imitates these designs and processes to solve human problems." The Biomimicry Institute and its president, Janine M. Benyus, author of the 1997 book Biomimicry (New York: William Morrow), which popularized this field of study, is a resource for designers and companies interested in learning to observe nature and apply the same type of economical wisdom to issues ranging from mundane to existential, such as how to reduce our erosion of the world's resources.

17.
Engineer Cecil Balmond (of Arup), assisted by Jenny Sabin, teaches in the University of Pennsylvania's School of Design, in the Department of Architecture. The quotation was taken from a description of the course for the spring 2007 semester. It continues, "The nano prefix means one-billionth, so a nanometer is one-billionth of a meter. Just as antibiotics, the silicon transistor and plastics... nanotechnology is expected to have profound influences in the twenty-first century, ranging from nanoscopic machines that could for instance be injected in the body to fix problems and the creation of artificial organs and prosthetics, all the way to self-assembling electronic components that behave like organic structures and better materials that perform in novel ways." Chris Lasch and Benjamin Aranda, in a conversation with the author on March 14, 2007, talked about the role of algorithms in architecture, also well explained in their incisive volume Tooling (New York: Princeton Architectural Press, 2005). Richard A. L. Jones's blog is a precious resource for all those who want more information on the potential practical applications of nanotechnology in our future (see also note 4). See www.softmachines.org.

18.
A few of my personal favorites: the historical International Design Conference in Aspen, now defunct, the ongoing TED (Technology, Entertainment, Design, founded by Richard Saul Wurman and now run by Chris Anderson), and Doors of Perception (founded and still run by John Thackara).

Anthony Dunne and Fiona Raby's outstanding design work is focused on sparking debate. As educators, they are both involved with the Royal College of Art, London, where Dunne is the head of the Design Interactions Department and Raby a tutor. The Design Interactions students explore the impact of the most advanced technologies on our daily routines, in particular the design potential of biotechnology and nanotechnology, both of which are now moving out of the research laboratory and into daily life. The resulting projects, a number of which are included in this volume, aim to raise a debate on the social, cultural, and ethical implications of emerging technologies.

Anthony Dunne (British, born 1964) and
Fiona Raby (British, born 1963)
Dunne & Raby (UK, est. 1994)
Technological Dreams Series: no 1, Robots
Models. 2007

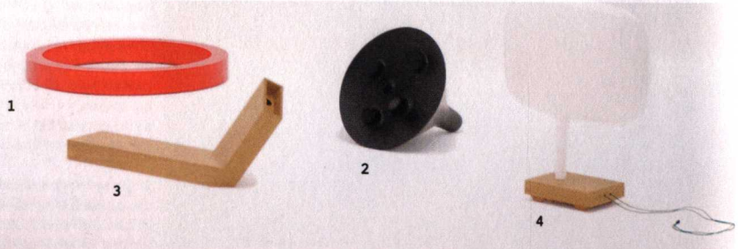
As technology advances and robotic experiments abound—ranging from the pragmatic to the exquisitely absurd—designers are taking a closer philosophical look at our future interaction with robots. Will they be subservient, intimate, dependent, equal? Will they take care of us or will we take care of them? Anthony Dunne and Fiona Raby look at robots as individuals with their own distinct personalities and quirks, thinking that devices of the future might not be designed for specific tasks but instead might be given jobs based on behaviors and qualities that emerge over time.

Robot 1
High-density foam, 4 × 35 3/8" (10 × 90 cm) diam.
Robot 1 is very independent, but it needs to avoid electromagnetic fields, as these might cause it to malfunction.

Robot 2
Acrylic, 19 3/4 × 19 3/4" (50 × 50 cm) diam.
Robot 2 is very nervous; as soon as someone enters a room it turns to analyze them with its many eyes, becoming extremely agitated if the person gets too close.

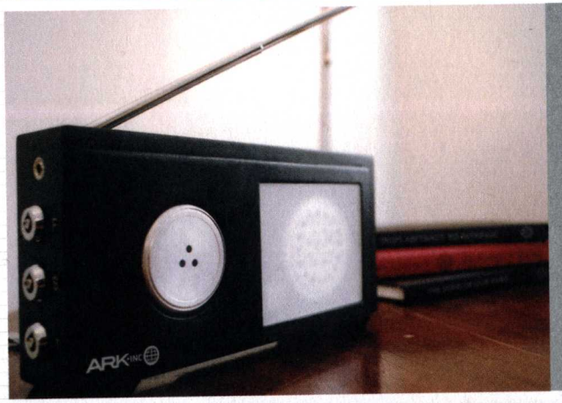
Robot 3
English oak and acrylic, 15 3/8 × 8 × 36 3/4" (39 × 20 × 93.3 cm)
Robot 3 is a sentinel; it uses retinal scanning technology and demands that the user stare into its eyes for a long time to be recognized.

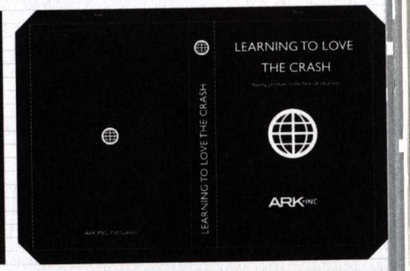
Robot 4
English oak, 32 × 18 7/8 × 6" (75 × 48 × 158 cm)
Robot 4 is very needy and depends on its owner to move it about. It is also extremely smart and has even evolved its own language, although you can still hear human traces in its voice.

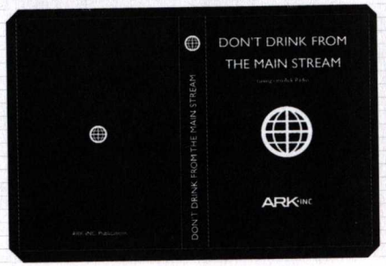


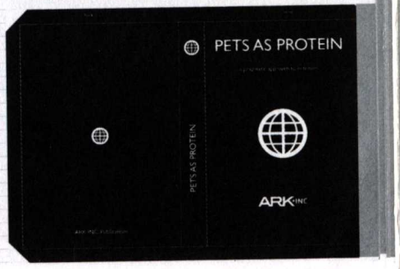
Jon Ardern (British, born 1978)
Design Interactions Department (est. 1989),
Royal College of Art (UK, est. 1837)
ARK-INC Concept. 2006

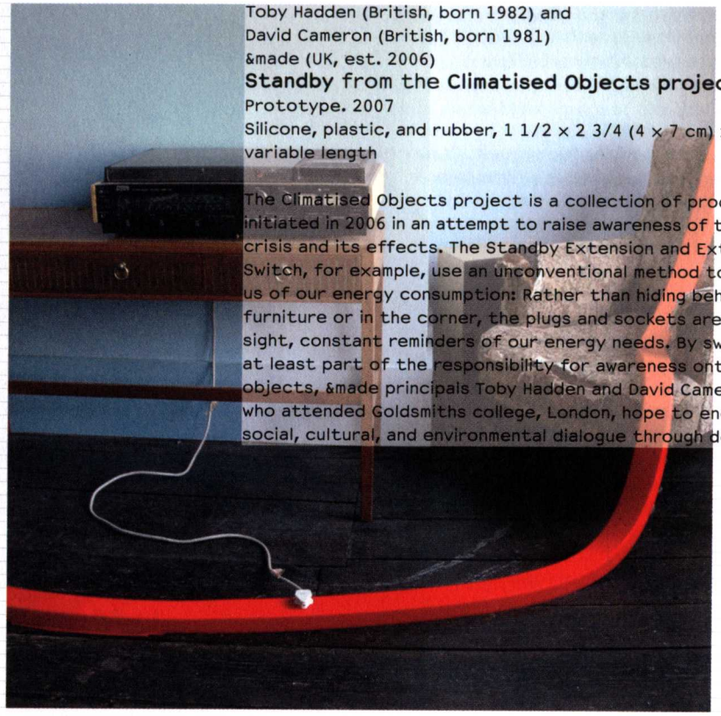
According to Jon Ardern, a graduate of the Royal College of Art's Design Interactions Department, it is too late to fix the damage human beings have inflicted upon the earth and society. Better to cut our losses and instead adapt our lifestyle to the changed conditions. It is on these sunny premises that Ardern has built his project of imagined social structures and services for "a cultlike investment company, called the Ark, that keeps you up-to-date on how badly the world is doing while reassuring you that your investment in post-crash life is doing well." Based on the assumption that the abstract-value principle of the traditional economy will be rendered useless, ARK-INC provides a range of products, from manuals and books to films and radio broadcasts, that keep users informed of external data such as wars and social breakdown. It also mediates the transition to post-crash civilization with services such as holidays in apocalyptic landscapes, designed to help users cope with disaster.











Toby Hadden (British, born 1982) and
David Cameron (British, born 1981)
&made (UK, est. 2006)
Standby from the Climatised Objects project
Prototype. 2007
Silicone, plastic, and rubber, 1 1/2 × 2 3/4 (4 × 7 cm) × variable length

The Climatised Objects project is a collection of products initiated in 2006 in an attempt to raise awareness of the climate crisis and its effects. The Standby Extension and Extension Switch, for example, use an unconventional method to remind us of our energy consumption: Rather than hiding behind furniture or in the corner, the plugs and sockets are in plain sight, constant reminders of our energy needs. By switching at least part of the responsibility for awareness onto the objects, &made principals Toby Hadden and David Cameron, who attended Goldsmiths college, London, hope to encourage social, cultural, and environmental dialogue through design.

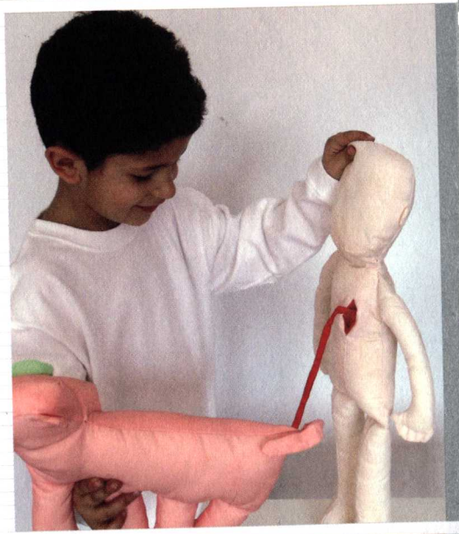
Elio Caccavale (Italian, born 1975)

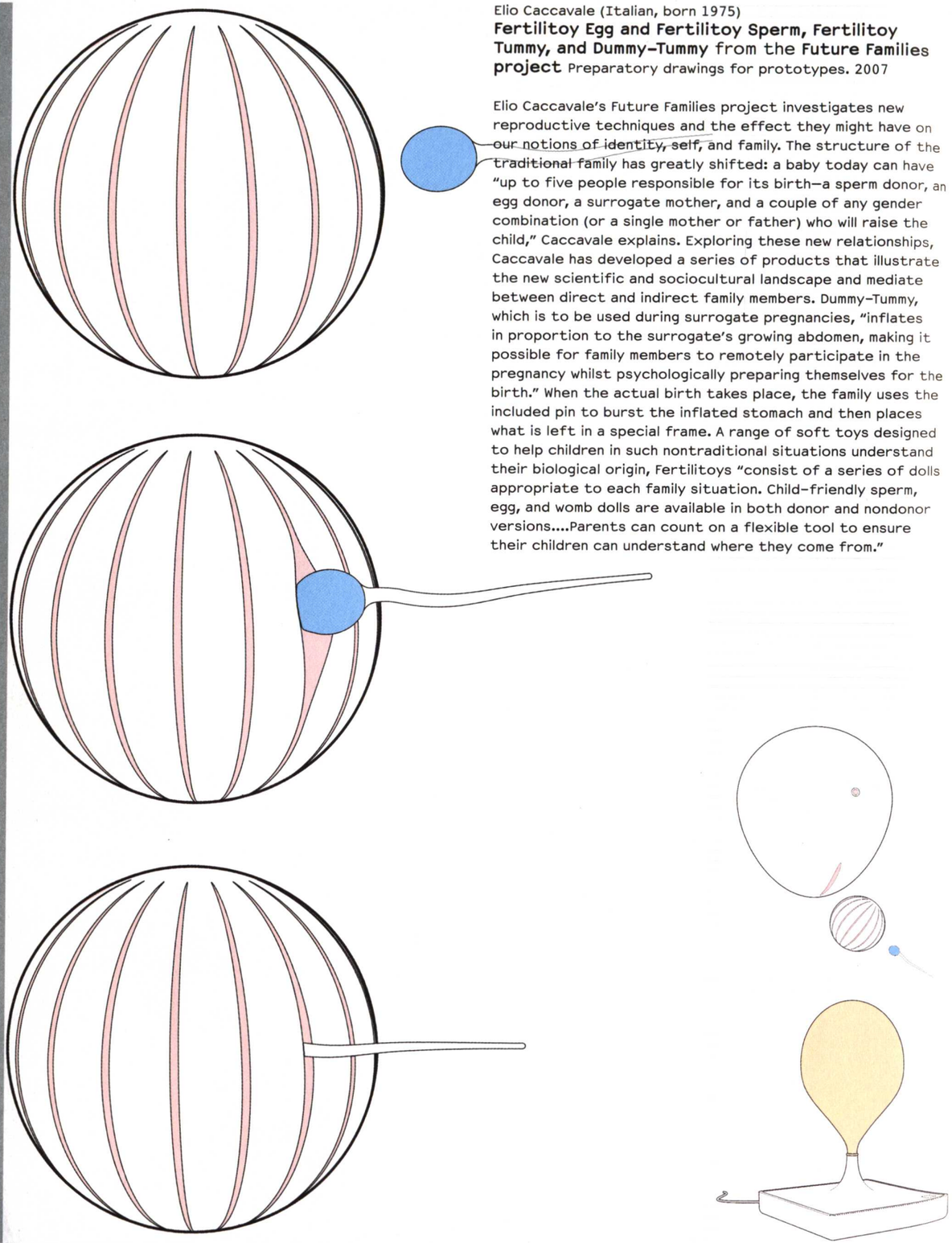
MyBio-reactor Cow Prototype. 2005
Fireproof nylon and polyester stuffing, 7 1/2 × 13 3/4 × 9 1/2" (19 × 35 × 24 cm)

MyBio Xenotransplant Prototype. 2005
Fireproof nylon and polyester stuffing, boy: 7 1/2 × 6 1/4 × 17 3/4" (19 × 16 × 45 cm); pig: 7 1/2 × 9 7/8 × 11 3/4" (19 × 25 × 30 cm)

MyBio Spider Goat Prototype. 2005
Fireproof nylon and polyester stuffing, 7 1/2 × 12 1/4 × 11" (19 × 31 × 28 cm)

"MyBio is a collection of toys exploring the emergence of biological hybrids in biotechnologies, as well as our moral, social, cultural, and personal response to these 'transhuman' creatures," explains Elio Caccavale, a graduate of the Royal College of Art's Design Products Department. Each one of his twelve MyBio dolls symbolizes a possible biofuture and introduces young children to emerging technologies, inviting them to think about the ways biotechnology can affect their lives. MyBio-reactor Cow, for instance, depicts in a graphic way—with the "milk thread" attached to the cow's udder—how cows' milk provides proteins for pharmaceutical drugs. Similarly, MyBio Spider Goat, with a spiderweb attached to the goat's udder, demonstrates the famous 2001 experiment in which goats' chromosomes were manipulated to include a spider gene so that their mammary glands could produce a strand of silk three times tougher than Kevlar. The two MyBio Xenotransplant dolls, MyBio Boy and MyBio Pig, demonstrate the physical transfer of an organ from animal to human. Caccavale also pursues the topic of organ transplants in his Utility Pets project (see pp. 112–13).



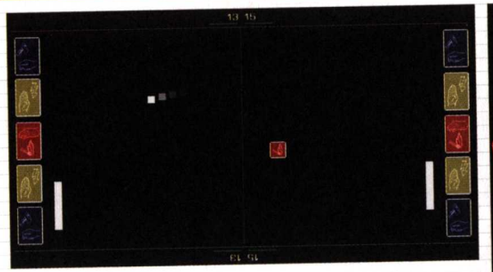


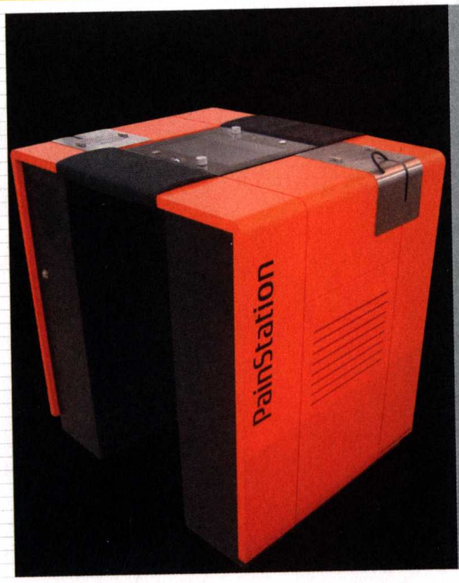
Elio Caccavale (Italian, born 1975)
Fertilitoy Egg and Fertilitoy Sperm, Fertilitoy Tummy, and Dummy-Tummy from the **Future Families project** Preparatory drawings for prototypes. 2007

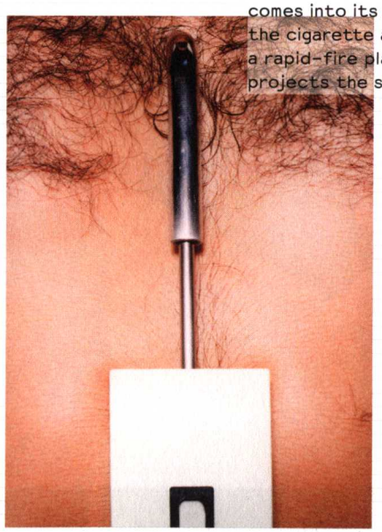
Elio Caccavale's Future Families project investigates new reproductive techniques and the effect they might have on our notions of identity, self, and family. The structure of the traditional family has greatly shifted: a baby today can have "up to five people responsible for its birth—a sperm donor, an egg donor, a surrogate mother, and a couple of any gender combination (or a single mother or father) who will raise the child," Caccavale explains. Exploring these new relationships, Caccavale has developed a series of products that illustrate the new scientific and sociocultural landscape and mediate between direct and indirect family members. Dummy-Tummy, which is to be used during surrogate pregnancies, "inflates in proportion to the surrogate's growing abdomen, making it possible for family members to remotely participate in the pregnancy whilst psychologically preparing themselves for the birth." When the actual birth takes place, the family uses the included pin to burst the inflated stomach and then places what is left in a special frame. A range of soft toys designed to help children in such nontraditional situations understand their biological origin, Fertilitoys "consist of a series of dolls appropriate to each family situation. Child-friendly sperm, egg, and womb dolls are available in both donor and nondonor versions....Parents can count on a flexible tool to ensure their children can understand where they come from."

Volker Morawe (German, born 1970) and Tilman Reiff (German, born 1971) of ////////fur/// art entertainment interfaces (Germany, est. 2001)
Academy of Media Arts, Cologne (Germany, est. 1994)
PainStation Prototype. 2001–04
Wood, steel, and custom electronics and mechanics, 39 3/8 × 39 3/8 × 31 1/2" (100 × 100 × 80 cm)

As Volker Morawe and Tilman Reiff explain, the main aspiration of contemporary game designers is to shape "compelling experiences that bridge the on-screen virtual world and the real world." Enter PainStation, a two-person console where making mistakes results in physical pain. The game is an adapted version of the classic 1972 Atari game Pong. The players, facing each other, "use their right hand to control a bat on screen, and must keep their left hand on the console's 'pain execution unit.' Removing the hand means breaking the circuit—game over." Every time the screen bat "misses a ball, the left hand suffers the consequences through the application of heat, electric shocks, or a quick whipping on the back of the hand." Not only do players become directly immersed in the game, but the combination of sound effects and the players' reactions makes it a compelling experience for the audience as well.







Noam Toran (American, born 1975)
Accessories for Lonely Men Models. 2001
Aluminum, plastic, and electronics

Noam Toran, a graduate of and professor in the Royal College of Art's Design Interactions Department, makes use of products and film as a means to investigate "anomalies in contemporary and speculative human behavior." The designer creates conceptual and darkly humorous products as well as their narratives and contexts. Accessories for Lonely Men are eight electronic devices designed to alleviate loneliness by simulating the "generic traces" that one's companion would normally leave behind. The collection includes a Sheet Thief set on a timer that "winds the bedclothes up on the other side of the bed while you're sleeping." Other joys of sharing a bed are re-created with a pair of Cold Feet and a Heavy Breather that breathes hot air down the user's neck. In the morning, the "Hair Alarm Clock attached to the headboard swishes hair onto the user's face to wake him up," while the steel finger of the Chest-Hair Curler rotates gently to swirl his chest hair in concentric circles. Other objects include Shared Smoke, which comes into its own after a solitary sex act, with one hole for the cigarette and another that exhales smoke; Plate Thrower, a rapid-fire plate launcher; and Silhouette Light, which projects the silhouette of a woman onto the wall.

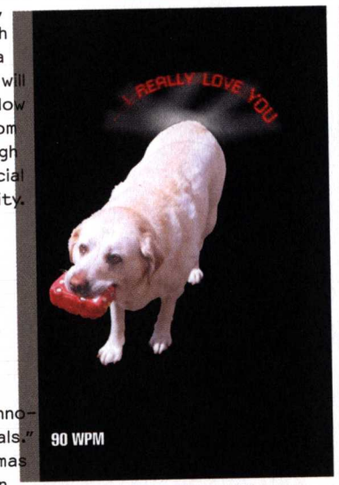
One of the most researched types of interaction design focuses on objects that respond to our needs and stimuli rather than awaiting our instructions. For the past twenty years, engineers, scientists, architects, and designers have been working toward transforming objects from tools to companions and buildings from containers to open environments, using ever more sophisticated movement- and voice-recognition software.

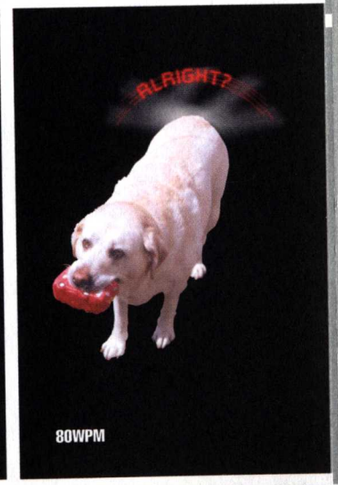
Martino d'Esposito (Swiss/Italian, born Cyprus 1976)
Frédéric Kaplan (French, born 1974) of CRAFT Laboratory (Centre de Recherche et d'Appui pour la Formation et ses Technologies) (est. 2002), École Polytechnique Fédérale de Lausanne (Switzerland, est. 1853)
Wizkid Prototype. 2006–07
ABS plastic and polymer, 17 3/4 × 9 7/8 × 8" (45 × 25 × 20 cm)

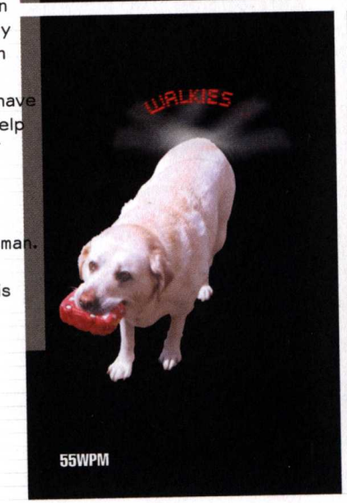
To switch on a Wizkid, you just have to look at it. "Wizkids do not speak," explain designers Martino d'Esposito, a former student of the École cantonale d'art de Lausanne (écal), and Frédéric Kaplan, an expert in artificial intelligence, "but they pay a lot of attention to what happens around them. When set in autonomous mode, Wizkids become curious about their environment and start learning by themselves." As days go by, a Wizkid will learn to recognize its user and his or her habits, and to react to each context and situation. It will help with cooking and shopping; it will take pictures of the guests at a party; it will play games with the kids. At the office, a Wizkid will be a valuable executive assistant. During meetings, it will follow the conversation just like any other participant, nodding from time to time. The user can monitor a Wizkid's progress through visualization tools and improve its learning curve through special toys and educational kits that will satisfy its enormous curiosity.

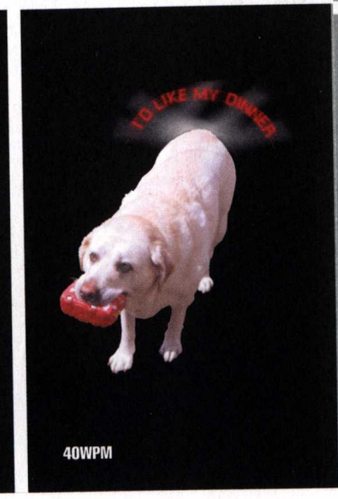
James Auger (British, born 1970) and
Jimmy Loizeau (British, born 1968)
LED Dog Tail Communicator from the **Augmented Animals project** Prototype. 2006
LEDs, programmed electronic components, and automated wagging tail, 8 × 13 3/4 × 11 3/4" (20 × 35 × 30 cm)

The Augmented Animals project imagines a world where "technological innovations are equally appreciated and used by animals." The products in the series fit into three categories: traumas of domestication, survival, and reputation enhancers. "When animals are domesticated they enter an uncertain territory between the natural and the artificial. They must live within human terms and conditions, dislocated from their original environment, often leading a frustrating life. Many animals have developed ingenious mechanisms of defense, and with the help of technology they can overcome evolutionary shortfalls," explain James Auger and Jimmy Loizeau. The LED Dog Tail Communicator spells out in human words the messages that a dog wants to convey to his owner via his wagging tail, enabling new forms of communication between animal and human. Auger and Loizeau, graduates of the Royal College of Art's Design Products program, are featured several times in this volume because of their lucid and poetic take on how technology can help communication and memory.



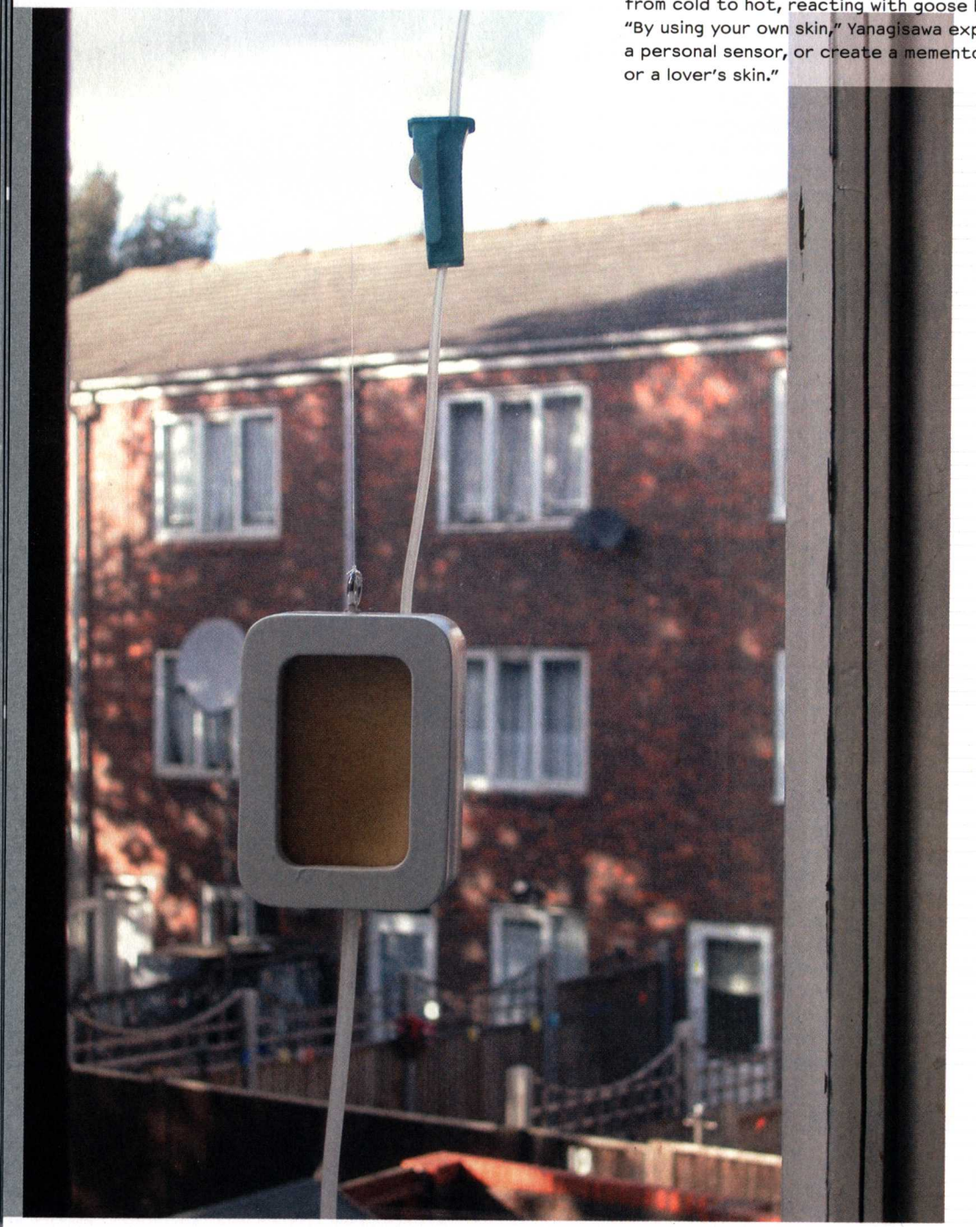






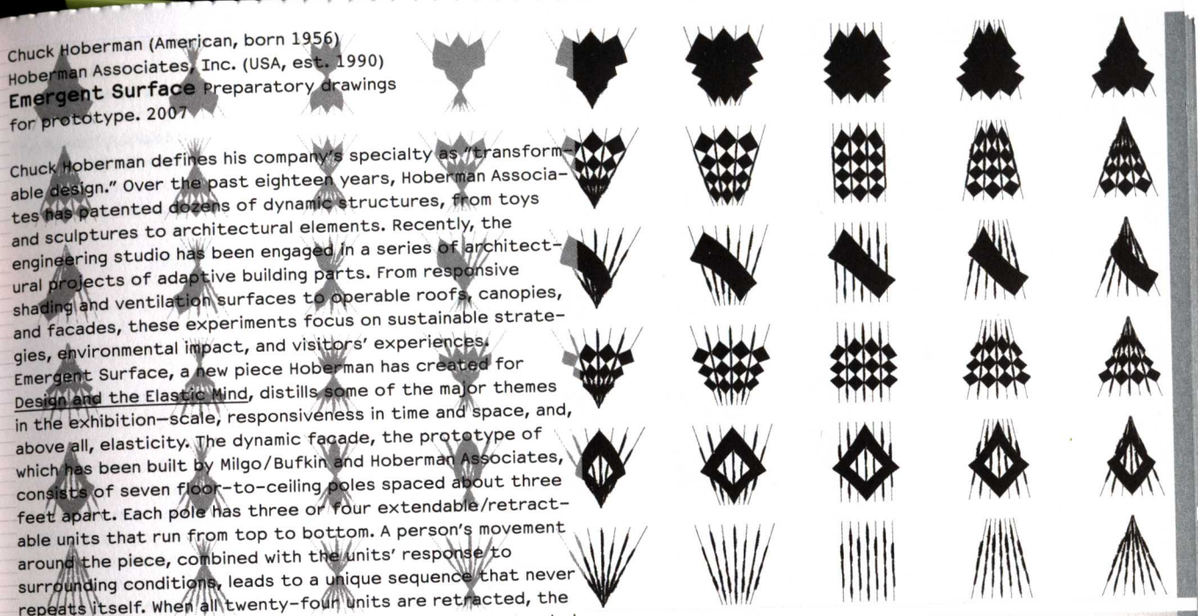
Tomoaki Yanagisawa (Japanese, born 1980)
Design Interactions Department (est. 1989),
Royal College of Art (UK, est. 1837)
Living Sensors Model. 2005
Latex, plastic, and intravenous drip tube, 3 1/2 × 2 1/2 × 1 3/4" (8.9 × 6.4 × 4.5 cm)

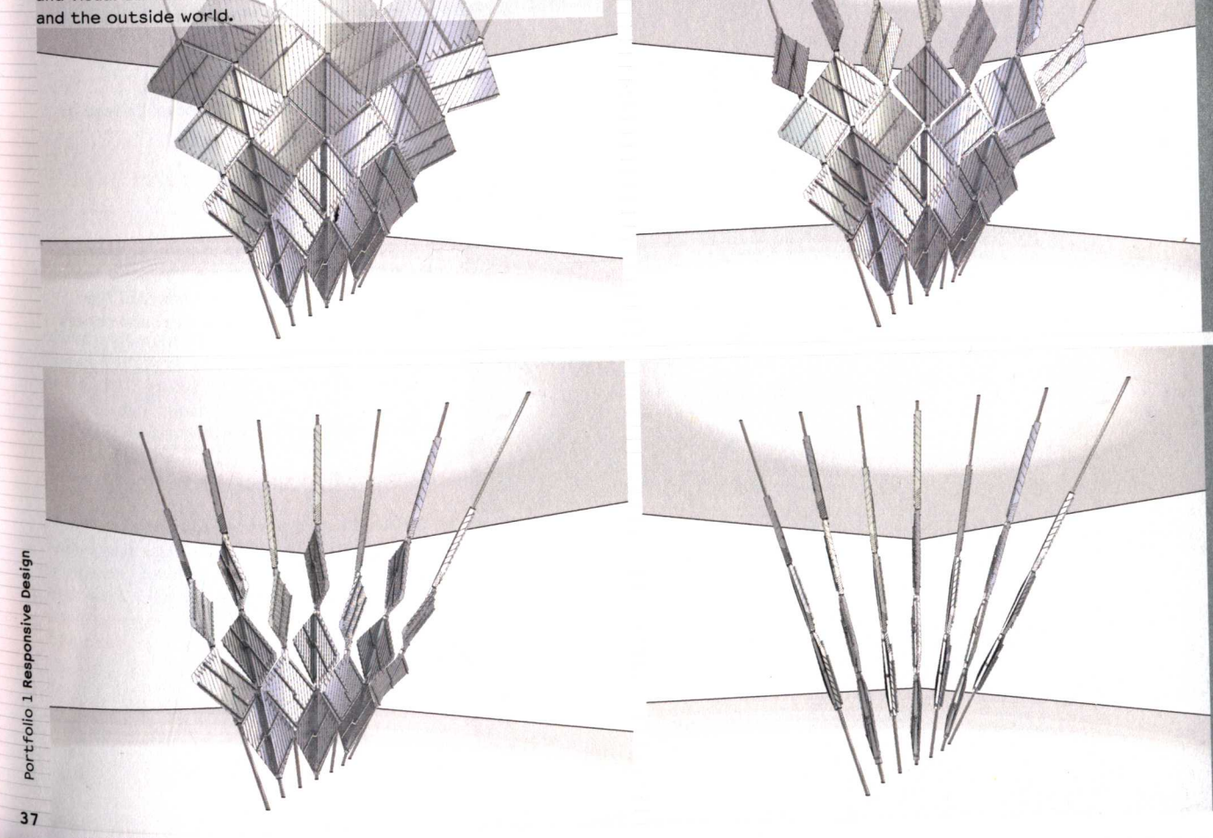
Designer Tomoaki Yanagisawa contemplates cloning technology as the generator of new experiences and behaviors. Through cloning, living human or animal skin could generate products capable of the most immediate interactions with their surroundings. A living sensor on a window, for example, communicates both visually and emotionally the feeling of temperature, from cold to hot, reacting with goose bumps or sweating. "By using your own skin," Yanagisawa explains, "you can have a personal sensor, or create a memento object with a pet's or a lover's skin."

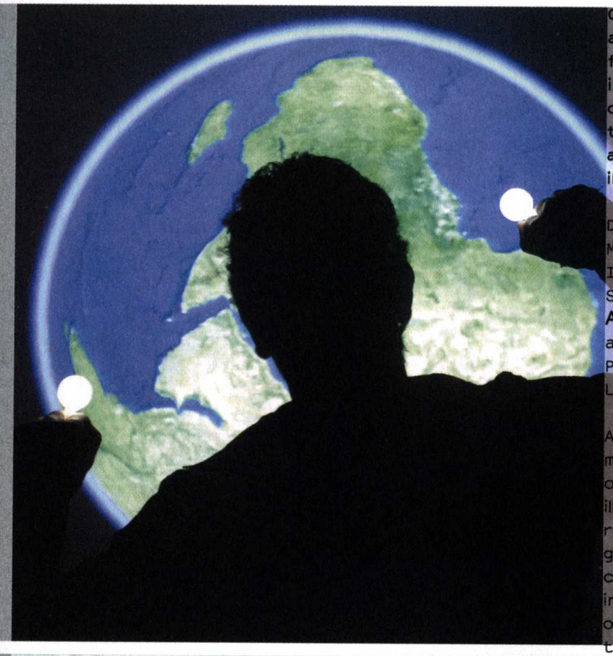


Chuck Hoberman (American, born 1956)
Hoberman Associates, Inc. (USA, est. 1990)
Emergent Surface Preparatory drawings for prototype. 2007

Chuck Hoberman defines his company's specialty as "transformable design." Over the past eighteen years, Hoberman Associates has patented dozens of dynamic structures, from toys and sculptures to architectural elements. Recently, the engineering studio has been engaged in a series of architectural projects of adaptive building parts. From responsive shading and ventilation surfaces to operable roofs, canopies, and facades, these experiments focus on sustainable strategies, environmental impact, and visitors' experiences. Emergent Surface, a new piece Hoberman has created for Design and the Elastic Mind, distills some of the major themes in the exhibition—scale, responsiveness in time and space, and, above all, elasticity. The dynamic facade, the prototype of which has been built by Milgo/Bufkin and Hoberman Associates, consists of seven floor-to-ceiling poles spaced about three feet apart. Each pole has three or four extendable/retractable units that run from top to bottom. A person's movement around the piece, combined with the units' response to surrounding conditions, leads to a unique sequence that never repeats itself. When all twenty-four units are retracted, the piece has minimal visual presence; when the units are extended, a curvilinear wall is formed, appearing flat or twisted depending on the point of view. The facade is able to provide shelter from different climate conditions and to filter the physical and visual communication between the interior of the building and the outside world.







One way for designers to make the public feel comfortable with advanced technology is to incorporate instinctive human traits, for example in interfaces that can be commanded by moving items around with hands and fingers, by blowing onto them, or even by shaking the computer where they reside. Although technologies of this kind have already found commercial applications, most famously in the Nintendo Wii and the Apple iPhone, designers keep staging ingenious new demonstrations.

Dan Phiffer (American, born 1980) and
Mushon Zer-Aviv (Israeli, born 1976)
Interactive Telecommunications Program (est. 1979), Tisch School of the Arts, New York University (USA, est. 1965)
Atlas Gloves Prototype. 2005–06
atlasgloves.org
Processing software, Java.awt.Robot library, Google Earth, LED keychains, and Webcam

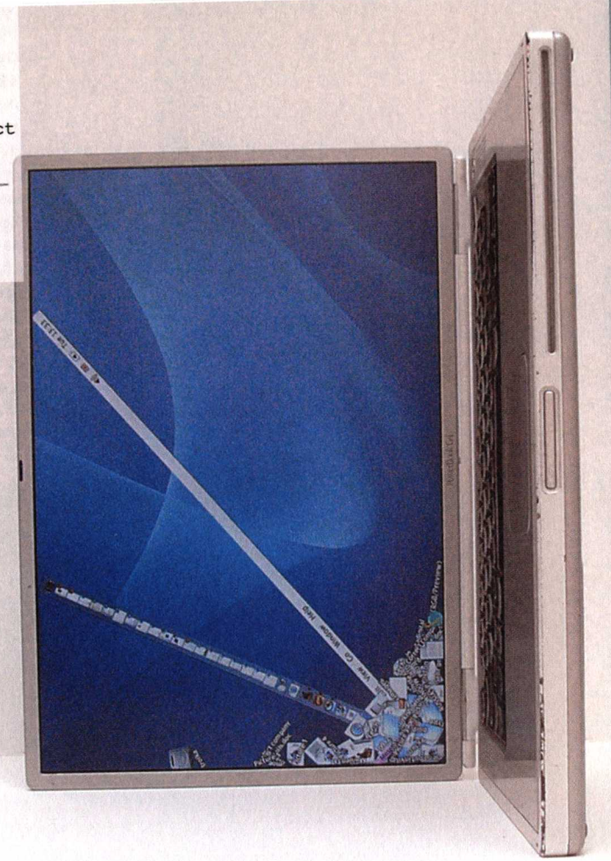
Atlas Gloves is a do-it-yourself physical interface for 3-D mapping applications like Google Earth. The user stands in front of a large-scale projection of the earth with a special set of illuminating gloves that track hand gestures like grabbing, pulling, reaching, and rotating. When the user gently squeezes the glove, an LED turns on, while a small camera attached to a computer tracks and translates each LED-enabled gesture into a set of possible actions: pan, zoom, rotate, and tilt. The open-source Atlas Gloves application can be downloaded from the Web site and operated from home using a Webcam and two self-made illuminating gloves. The Web site includes detailed instructions on how to make your own Atlas Gloves for about $8, using such common materials as ping-pong balls, glue, thread, pins, a nail, and LED keychains.

Eriko Matsumura (Japanese, born 1980)
Design Interactions Department (est. 1989), Royal College of Art (UK, est. 1837)
Hu-Poi Prototype. 2006
Epoxy resin and electronics, 23 5/8 × 2 3/8 × 2 3/8" (60 × 6 × 6 cm)

When faced with a cluttered room, the temptation at times is to clear the mess away in one sweeping gesture. The same feeling can happen in front of a cluttered computer desktop. The Hu-Poi interface allows for this unusual type of gestural control.

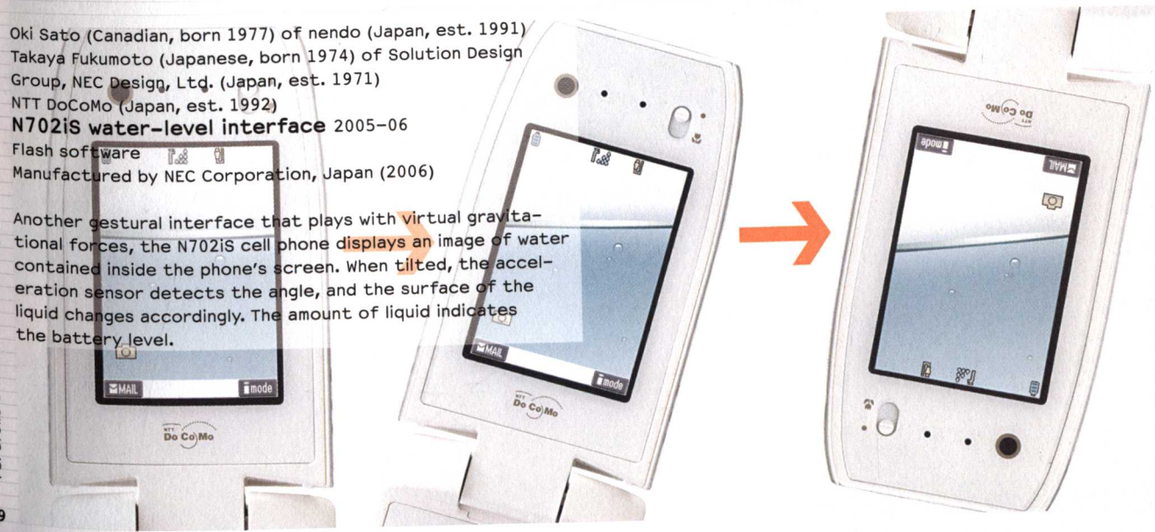
Troika (UK, est. 2003)
Newton Virus Prototype. 2005
Custom C++ software and Apple Sudden Motion Sensor

The Newton Virus suggests that laws of gravity also apply to interfaces, causing desktop icons to fall down as if subject to gravitational pull from the real world. Troika is developing other ideas for computer viruses as "an underexploited art form," using them for poetic purposes far from their traditional destructive and obstructive effects. Through their Web site, Troika's designers invite anyone with programming skills and imagination to participate in this challenge.



Oki Sato (Canadian, born 1977) of nendo (Japan, est. 1991)
Takaya Fukumoto (Japanese, born 1974) of Solution Design Group, NEC Design, Ltd. (Japan, est. 1971)
NTT DoCoMo (Japan, est. 1992)
N702iS water-level interface 2005–06
Flash software
Manufactured by NEC Corporation, Japan (2006)

Another gestural interface that plays with virtual gravitational forces, the N702iS cell phone displays an image of water contained inside the phone's screen. When tilted, the acceleration sensor detects the angle, and the surface of the liquid changes accordingly. The amount of liquid indicates the battery level.



Moritz Waldemeyer (German, born 1974)
Pong Table Prototype. 2006
DuPont Corian, aluminum, and electronic circuits,
62 3/4 × 35 3/8 × 28 1/2" (160 × 90 × 72.6 cm)
Prototype by DuPont, Belgium; 2D:3D, UK; and
Moritz Waldemeyer, UK (2006)

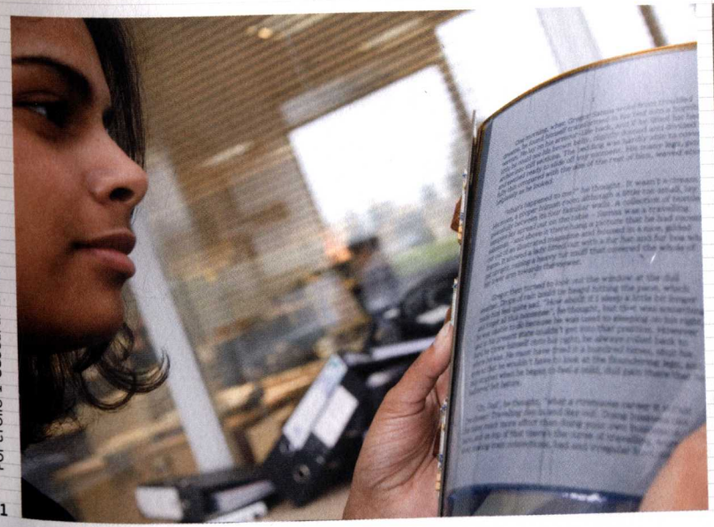
Moritz Waldemeyer's skills in mechanical, electronic, and software engineering fall into the so-called mechatronics area of technology. A talented designer in his own right, Waldemeyer has collaborated with architects and designers like Hussein Chalayan, Ron Arad, Yves Béhar, and Zaha Hadid. His first solo project is a collection of interactive electronic game consoles that double as dining tables. The table pictured here re-creates the classic game Pong, introduced by Atari in 1972 and the first commercially successful computer game. The tabletop has 2,400 LEDs and two track pads embedded in its surface, turning the white Corian into a digital gaming board. When turned off, the integrated technology disappears completely.

Much ink has been spilled on the future of print, on the disappearance of books and periodicals, and on the inexorable path toward a paperless future, yet we still cling to our paper-based artifacts. Despite the existence of several electronic reading devices, there are still a few hurdles left in the way of progress. One of them is our need to feel actual pages in our hands. Much research has been devoted to the development of pliable, ultra-thin displays that can be used not only for electronic books but also for such applications as TV sets and mutable credit/ID cards.

Miquel Mora (Spanish, born 1974)
Design Interactions Department (est. 1989),
Royal College of Art (UK, est. 1837)
Paper Alarm Clock from the **Flat Futures project: Exploring Digital Paper** Model. 2007
Paper and adhesive tape, folded: 1 7/8 × 1 7/8 × 1 7/8"
(4.8 × 4.8 × 4.8 cm); unfolded: 6 3/4 × 9 7/8" (17.6 × 25 cm)

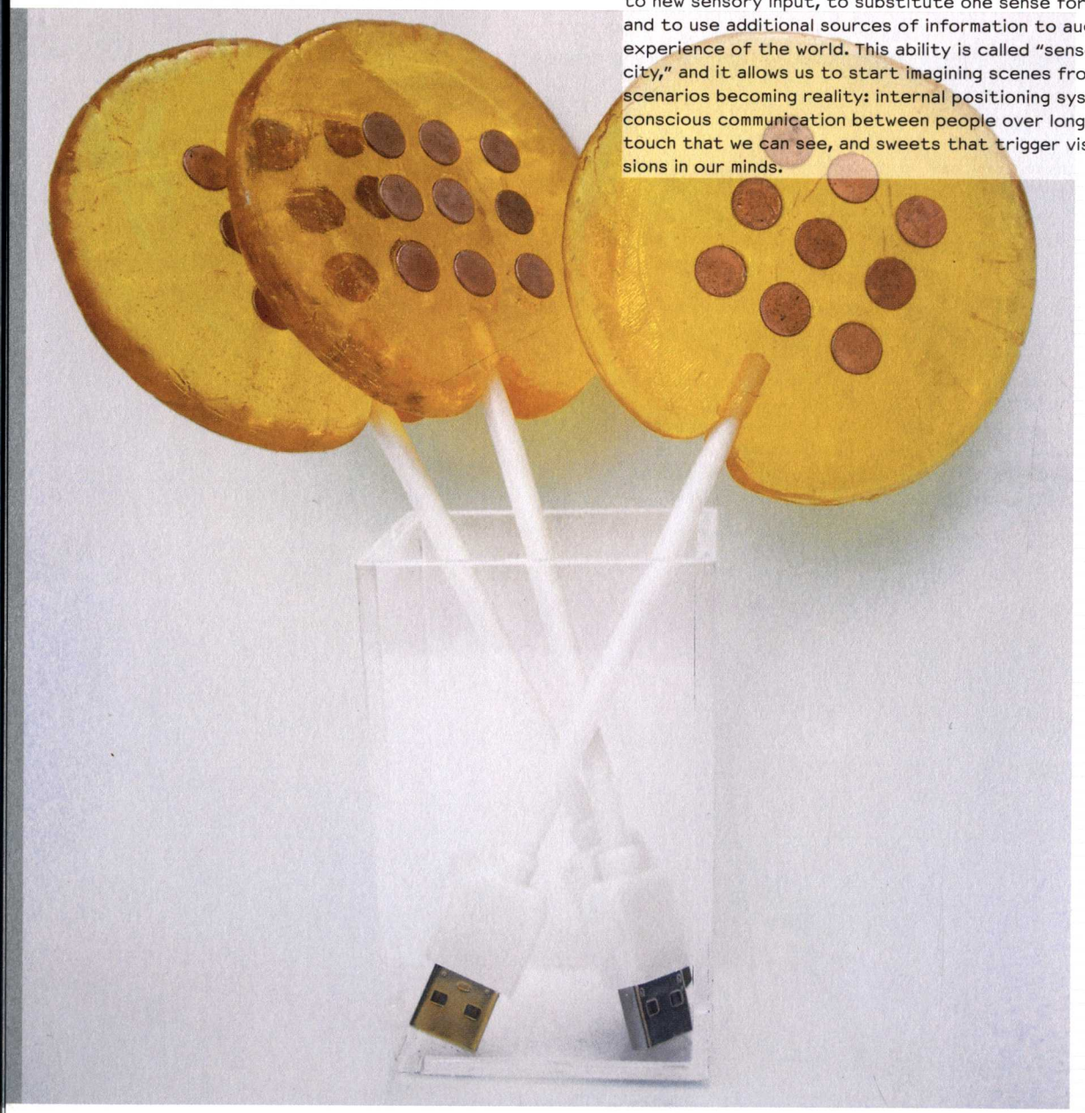
Plastic Logic (UK, est. 2000)
"take anywhere, read anywhere" flexible display 2006
E Ink Imaging Film, dimensions variable
Manufactured by Plastic Logic, UK (2008)

The Flat Futures project aims to enhance the characteristics of paper rather than remove it completely from our lives. Research done at the British company Plastic Logic and emerging technologies such as e-ink (a film that is integrated into electronic displays and that can be applied to almost any flat surface) and OLEDs (Organic Light-Emitting Diodes, a revolutionary innovation that will make flat, rollable, bright, and economical screens a reality) were the inspiration. Today it's possible to print electronics onto flat and flexible surfaces like paper or plastic, and flat processors, displays, and batteries can be quite easy and inexpensive to produce. In the Flat Futures project, Miquel Mora explores the possibility of printing electronic components onto adhesive tape, envelopes, and paper, such as the disposable Paper Alarm Clock, which needs to be scrunched up in order to be turned off.



Eyal Burstein (Israeli, born 1977) and
Michele Gauler (German, born 1973)
Beta Tank (UK, est. 2007)
Eye Candy from the **Sensory Plasticity project**
Models. 2007
Copper, steel, polyurethane, and sugar, 2 3/8 × 6 × 3/8"
(6 × 15 × 1 cm)

Scientists are currently exploring the brain's ability to process sensory stimuli as visual input, thus allowing, for example, blind people to navigate through space. A commercial application for people with balance impairments has already reached the marketplace: Wicab manufactures a balance-correcting device called the BrainPort, which works by sending tactile information through the tongue. Eyal Burstein and Michele Gauler explore the potential of this technology for people who are not visually impaired. Eye Candy is a metaphor for our brain's extraordinary elasticity—its potential to create new synapses and adapt to new sensory input, to substitute one sense for another, and to use additional sources of information to augment our experience of the world. This ability is called "sensory plasticity," and it allows us to start imagining scenes from sci-fi scenarios becoming reality: internal positioning systems, subconscious communication between people over long distances, touch that we can see, and sweets that trigger visual explosions in our minds.

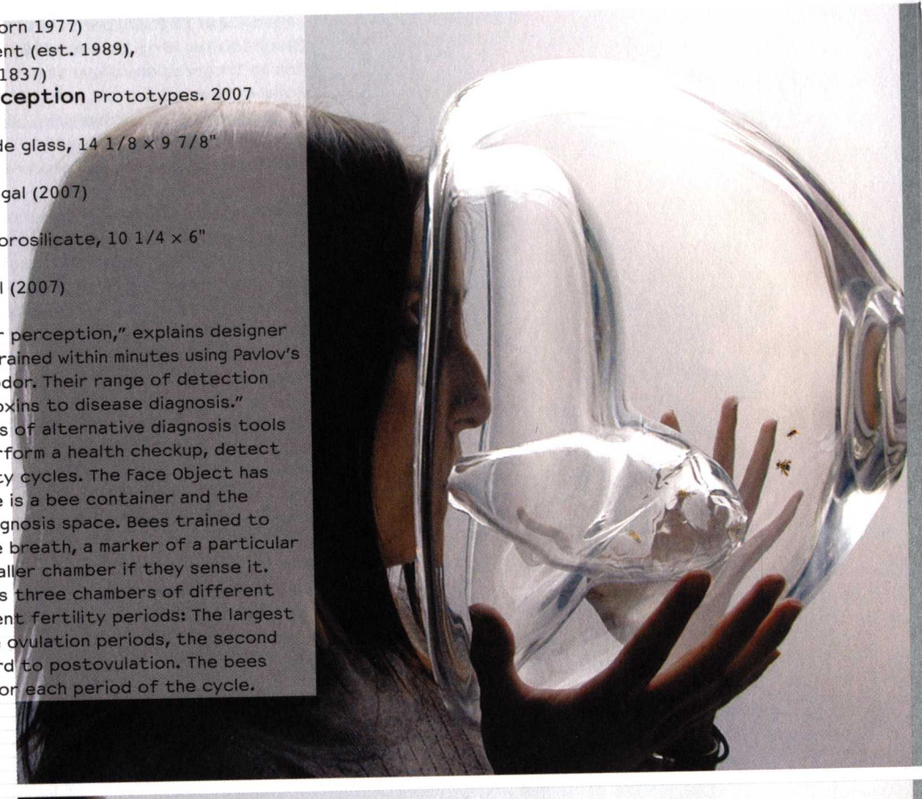


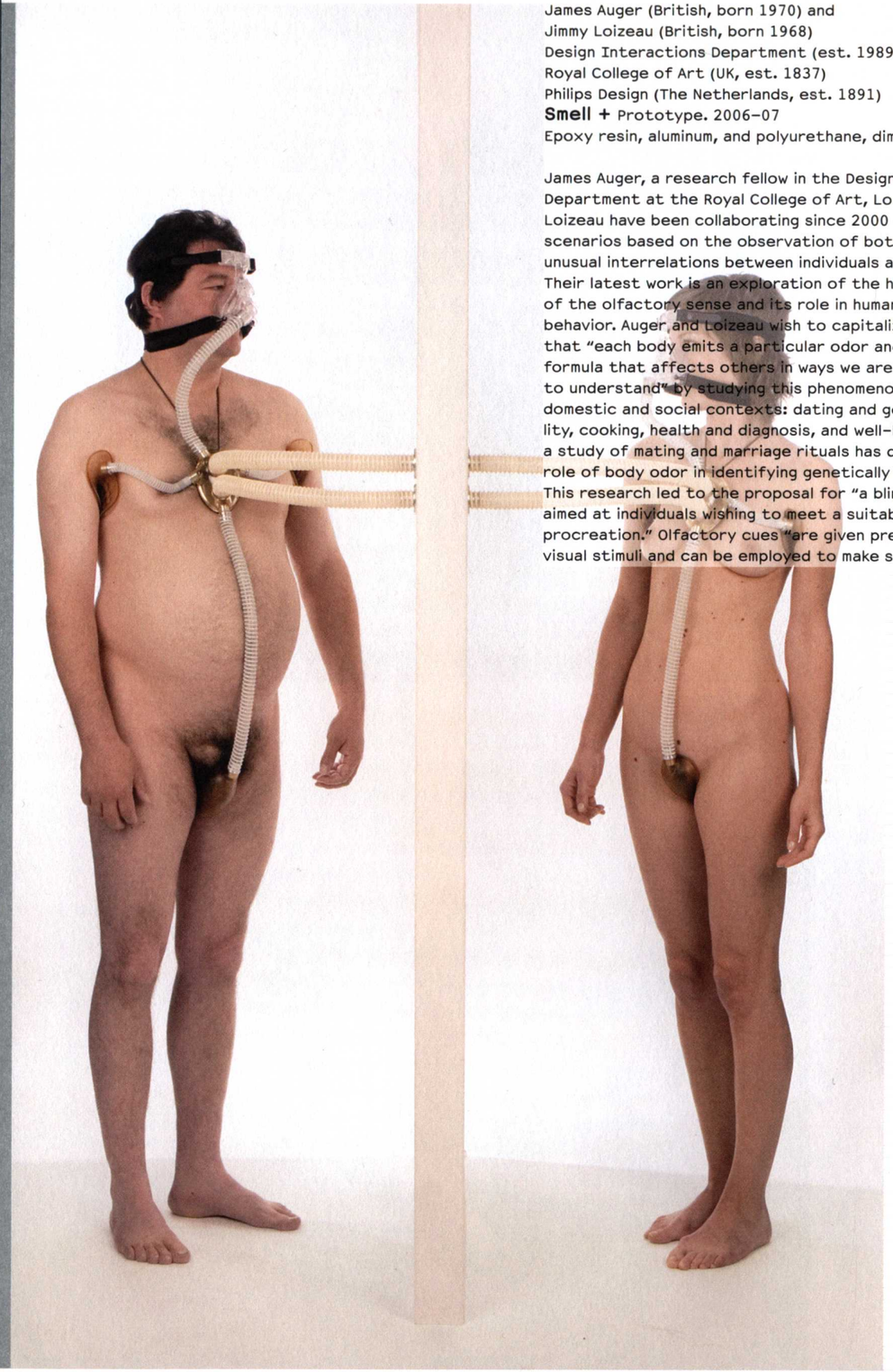
Susana Soares (Portuguese, born 1977)
Design Interactions Department (est. 1989),
Royal College of Art (UK, est. 1837)
BEE'S, New Organs of Perception Prototypes. 2007

Face Object: blown handmade glass, 14 1/8 × 9 7/8"
(36 × 25 cm) diam.
Prototype by Crisform, Portugal (2007)

Fertility Cycle Object: borosilicate, 10 1/4 × 6"
(26 × 15 cm) diam.
Prototype by Vilabo, Portugal (2007)

"Bees have a phenomenal odor perception," explains designer Susana Soares. "They can be trained within minutes using Pavlov's reflex to target a specific odor. Their range of detection goes from pheromones and toxins to disease diagnosis." Soares has conceived a series of alternative diagnosis tools that use trained bees to perform a health checkup, detect diseases, and monitor fertility cycles. The Face Object has two chambers: The larger one is a bee container and the smaller one serves as the diagnosis space. Bees trained to target a specific odor in the breath, a marker of a particular condition, will go into the smaller chamber if they sense it. The Fertility Cycle Object has three chambers of different sizes, relating to the different fertility periods: The largest chamber corresponds to the ovulation periods, the second to preovulation, and the third to postovulation. The bees fly into a specific chamber for each period of the cycle.





James Auger (British, born 1970) and
Jimmy Loizeau (British, born 1968)
Design Interactions Department (est. 1989),
Royal College of Art (UK, est. 1837)
Philips Design (The Netherlands, est. 1891)
Smell + Prototype. 2006–07
Epoxy resin, aluminum, and polyurethane, dimensions variable

James Auger, a research fellow in the Design Interactions Department at the Royal College of Art, London, and Jimmy Loizeau have been collaborating since 2000 on objects and scenarios based on the observation of both routine and unusual interrelations between individuals and technology. Their latest work is an exploration of the hidden potential of the olfactory sense and its role in human interaction and behavior. Auger and Loizeau wish to capitalize on the fact that "each body emits a particular odor and pheromone formula that affects others in ways we are just now starting to understand" by studying this phenomenon in a range of domestic and social contexts: dating and genetic compatibility, cooking, health and diagnosis, and well-being. For instance, a study of mating and marriage rituals has demonstrated the role of body odor in identifying genetically appropriate mates. This research led to the proposal for "a blind dating agency aimed at individuals wishing to meet a suitable partner for procreation." Olfactory cues "are given precedence over visual stimuli and can be employed to make successful matches."

Mathieu Lehanneur (French, born 1974)
Elements project Prototypes. 2006

Q Quinton Spray
Stainless steel, PVC coating, and sensor, dimensions variable

dB White Noise Diffuser
ABS plastic, mini speakers, electric engine, and charger, 7 1/8" (18 cm) diam.

C° Infrared Heating
Elastomer, thermal camera, infrared heating, and memory-shape alloy, 9 7/8 × 26" (25 × 66 cm) diam.

K Day Light Receiver–Transmitter
Aluminum, optical fibers, photoelectric cells, high-luminosity white LEDs, and sensor, 11 × 11 × 11 3/4" (28 × 28 × 30 cm)

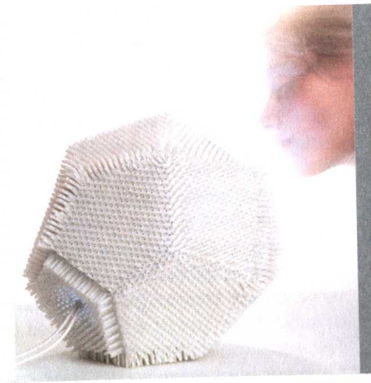
O Oxygen Generator
Glass, aluminum, Spirulina platensis, magnetic stirrer, white LEDs, and oximetric probe, 18 1/2 × 16 1/2" (47 × 42 cm) diam.

Our bodies are continually adapting to the changing environment. Designer Mathieu Lehanneur proposes to reverse the process with his Elements, domestic appliances that create microenvironments customized for each person in the household. Each Element works autonomously and is always alert, monitoring conditions—air quality, light, body temperature, background noise, and movement—and instantaneously acting to keep them in ideal balance. Lehanneur has worked with biologists, sleep specialists, and noise technicians to produce a collection of devices that allows the home to work "like the epidermis, reactive and capable of sensitivity to and receptivity of our states."

The dB White Noise Diffuser "moves around like a rolling ball capturing the sound level." It gravitates toward the source of a sound to create a band of white noise that "enables the brain to adjust to it and no longer be disturbed by the outside nuisance."

C° Infrared Heating acts like an intelligent thermal radar, a "campfire located at the heart of a room" that perceives temperature variations in those close to it and emits targeted heat toward those different zones.

The K Day Light Receiver-Transmitter, a light that protects from seasonal affective disorder, has sensors that monitor and average the light from the past twenty-four hours and activate a strong light for a period of a few seconds up to several minutes to regulate our biorhythms.



The Q Quinton Spray, an immune system booster, diffuses two types of marine mineral concentrates, depending on whether it is morning or evening and whether the person is going out or returning home. The Quinton isotonic serum restarts the metabolic functions of the organism while a hypertonic serum stimulates the immune system and the body's elimination functions.

The O Oxygen Generator, "a veritable domestic breathing machine," uses an oximeter sensor that activates oxygen-producing Spirulina platensis organisms, a system being studied by NASA for astronauts' long trips in space.

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Design and the Elastic Mind celebrates the endless and restless curiosity of human beings and praises design as an expression of creativity and an affirmation of life. For this reason, I would like to dedicate this book and this show to the late Herbert Muschamp, who certainly knew what I am talking about.

Paola Antonelli
Senior Curator, Department of Architecture and Design

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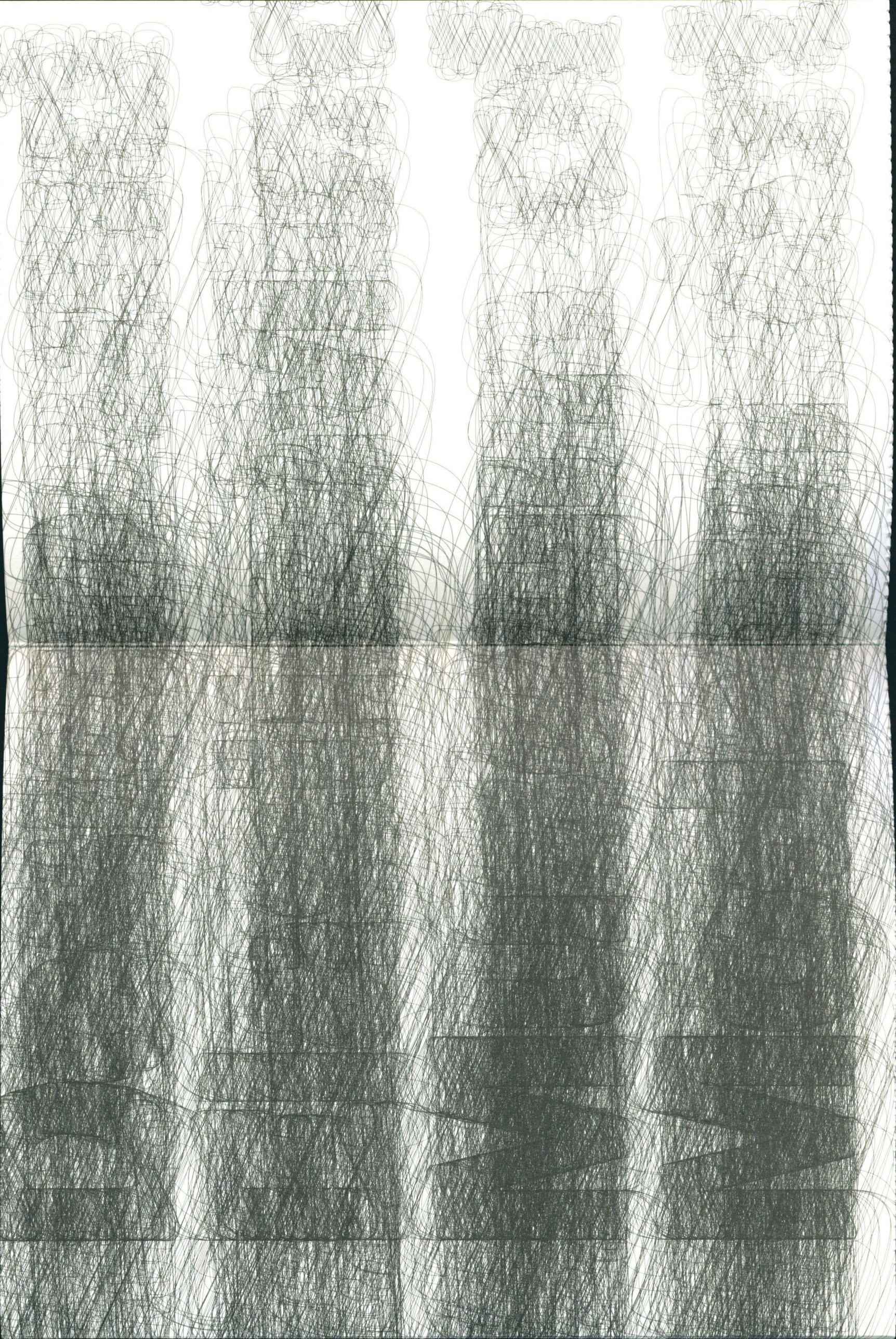

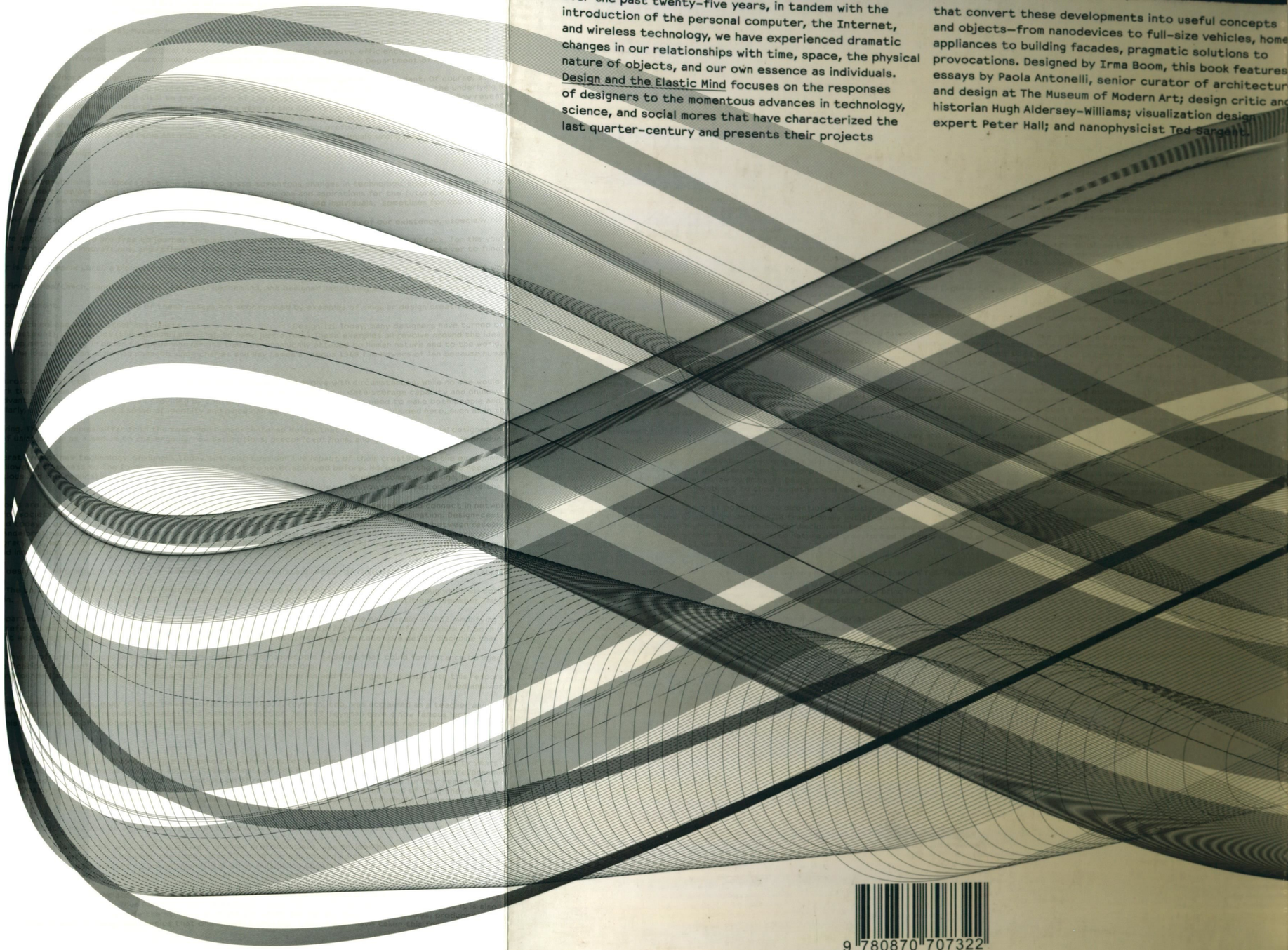

Over the past twenty-five years, in tandem with the introduction of the personal computer, the Internet, and wireless technology, we have experienced dramatic changes in our relationships with time, space, the physical nature of objects, and our own essence as individuals. Design and the Elastic Mind focuses on the responses of designers to the momentous advances in technology, science, and social mores that have characterized the last quarter-century and presents their projects that convert these developments into useful concepts and objects—from nanodevices to full-size vehicles, home appliances to building facades, pragmatic solutions to provocations. Designed by Irma Boom, this book features essays by Paola Antonelli, senior curator of architectur and design at The Museum of Modern Art; design critic and historian Hugh Aldersey-Williams; visualization design expert Peter Hall; and nanophysicist Ted Sargent.

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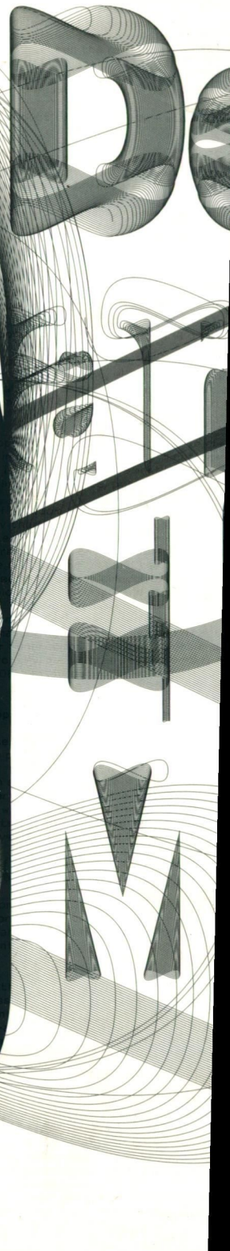
Antonelli

Design and the Elastic Mind

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