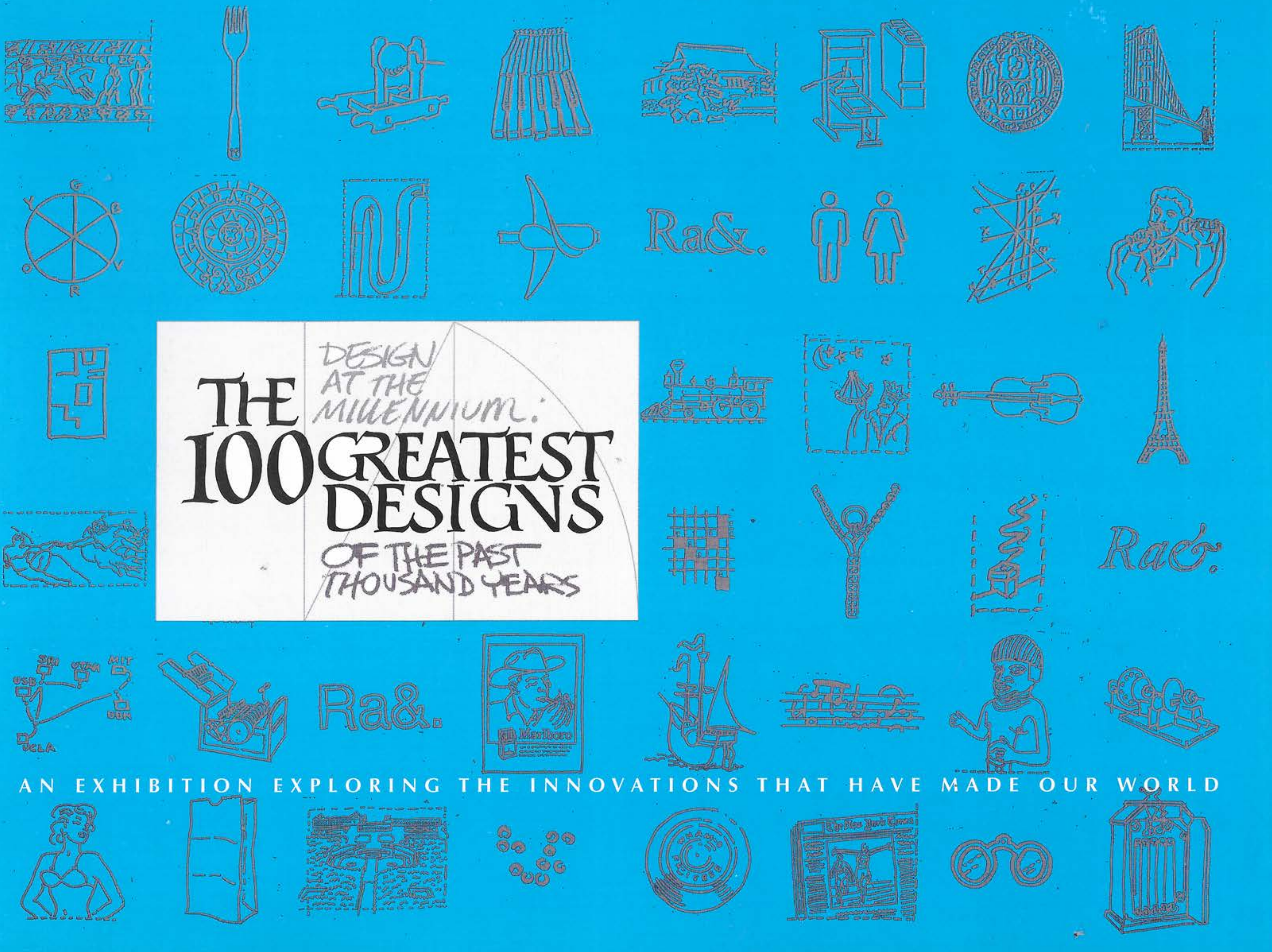
# Design at the Millennium: The 100 Greatest Designs of the Past Thousand Years




AN EXHIBITION EXPLORING THE INNOVATIONS THAT HAVE MADE OUR WORLD

The goal may be aesthetic as in decorative wallpaper, or strategic, as in a military campaign, but in both cases designing—making a plan to accomplish an objective—is the core activity

MARTIN HOLLOWAY

DESIGN BEGINS WHEN PERCEPTIVE MAN VIEWS HIS WORLD, AND DOES NOT LIKE WHAT HE SEES, HENCE HE MUST AFFECT OR MODIFY IT

HELEN MARIE EVANS

Design is the means by which we order our surroundings, re-shaping natural materials to suit our needs & purposes

PHILIP RAWSON

LESS IS MORE

LUDWIG MIES VAN DER ROHE

any attempt to make design a thing-by-itself works counter to the fact it is the primary underlying matrix of life

VICTOR PAPANEK

LESS IS A BORE

ROBERT VENTURI

the proper study of mankind is the science of design

H.A. SIMON

The selecting and organizing of materials to achieve a desired effect is designing

HELEN MARIE EVAN

DESIGN AT THE MILLENNIUM:

# THE 100 GREATEST DESIGNS

OF THE PAST THOUSAND YEARS

The rectangular symbol used in the logo and throughout the exhibition is called The Golden Section. It was devised by ancient Greek mathematicians to illustrate ideal proportions that could be applied to a wide range of design applications from art and architecture to engineering and music. It is used here to represent the quest for solutions to the problems of our less-than-ideal world.

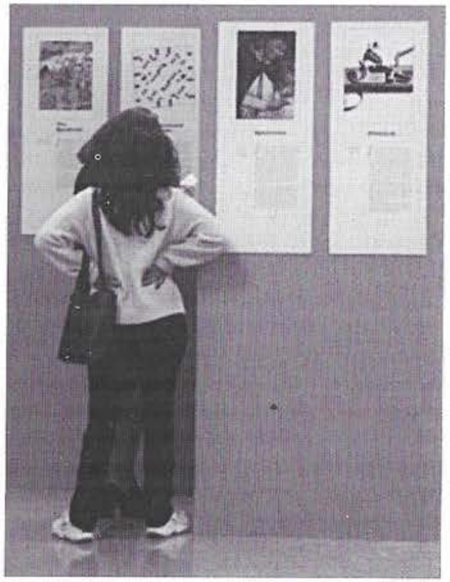
**An exhibition exploring the innovations that have made our world**

October 3 through
October 25, 2000

**THE DESIGN CENTER**

Downs Hall
Kean University
Union NJ 07083

Catalog design and illustrations by Martin Holloway



# INTRODUCTION

*The 100 Greatest Designs of the Past Thousand Years* is the second in a series of annual exhibitions presented by The Design Center on the campus of Kean University. Free and open to the public, these exhibitions are intended to fulfill the mission of The Design Center which is to educate the public about the impact of design on society.

The exhibition was conceived and designed by Alan Robbins, Associate Professor in the Department of Design and director of The Design Center. Martin Holloway, Chair of the Department of Design, helped in the planning of the exhibition and also designed the logo, poster, and catalog. Students in The Design Studio in Fall 2000 helped with the construction and mounting of the exhibition.

The examples of Greatest Designs that became part of the exhibition were selected with the help of design educators and practitioners throughout New Jersey who responded to a questionnaire eliciting their ideas. This catalog presents the original text that accompanied each of the selections.



# ACKNOWLEDGMENTS

The Design Center would like to thank the following members of the Kean University community for helping to make this exhibit possible: Dr. Ronald Applbaum, President of Kean University; Melissa Bahleda, Office of the President; Eduardo DelValle and Paul Magrino, Office of Facilities Management; and Patrick Ippolito, Vice President of Student Affairs.

We would also like to thank Branislav Bogdanovic and John Ko who helped with the preparation and design of this catalog, and the other students in The Design Studio in Fall 2000, for their help in mounting the exhibit.

Thanks too to the following educators and designers who helped us select the entries for the exhibition: Kevin Allen, Rob Barth, Robert Cirasa, John Davalos, Myrna Davis, Mary Degnan, Rose Gonnella, Matt Halper, James Howard, Robin Landa, Luba Lukova, Tony Scelba, and Stuart Topper.

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# THE CHALLENGE OF GREAT DESIGN

*Alan Robbins*
DIRECTOR, THE DESIGN CENTER

**Defining Design**

Design is a word in transition.

It is a dynamic word that points to the complex, fluid process by which we manifest our ingenuity and make things. The word design marks the intersection between creativity, purpose, planning, and production. Yet these processes are continually in flux, changing with the times and with our changing technologies, materials, activities, dreams. As a result, our use of the word design evolves as well.

The word has been used variously to refer to the plan or strategy for making something as opposed to the actual construction of it; the visual look of a thing rather than its functional workings; the creation and production of projects that solve problems rather than those that result from self-expression.

But to celebrate the new millennium and to encompass a thousand years of innovation, we have tried to approach design in the broadest sense using all these definitions and more. This is a word, after all, used in engineering, visual communications, science, music, architecture, and many other fields.

We have therefore used it throughout this exhibition to mean the entire process – from thought to thing, idea to item – by which we remake the world for our own purposes. This includes form (the look and style), structure (the physical arrangement), function (the purpose and use), and context (the cultural meaning and impact). Seen in this light, design is the basic process by which we harness our creative energy to make real and tangible things in our everyday lives. Design is the way the world of our making gets made.

The best way to grasp this broad approach through the selections themselves, which provide a functional meaning of the term design as it is actually used. Taken all together, they exemplify, illuminate, and explain our understanding of the evolving word *design* better than any static definition could.

**Making The Selections**

The examples of greatest designs from the past thousand years that were selected for this exhibit cover fields as diverse as engineering, advertising, and chemistry. Some had the kind of social impact that make them icons of their time and place; some were so innovative that they are seen as radical new solutions to problems; others were so perfectly realized at their inception that they have barely changed throughout history.

To select only 100 items from the uncountable innovations that have emerged throughout a millennium is a formidable – one might even say foolhardy – task. To help us with this imposing challenge, questionnaires were sent out to hundreds of New Jersey design educators and practitioners asking for their input, a list that was eventually pared down to the selections of the exhibit.

One lesson that emerged from this process was that the greatness of a design did not necessarily mean that its influence was benign. The ultimate effect of our most hopeful work is not always positive. Greatest is therefore used here as a practical assessment if not an ethical evaluation. Perhaps the first thing to capture an innovative idea, or the best example of an influential object, or the most familiar version of a commonly recognized design, or some combination of these. Many of which have had an ambiguous impact on the world, to say the least.

To finalize our choices, designs did have to be pinned down, sometimes without mercy. Thus the selections made are specific examples, not general categories of objects or processes or theories or discoveries. One of the most difficult challenges in making the selections was picking one design version over many others for any particular type of object.

Any 100 Greatest list is, of course, a game; but one well worth playing. Given its limitations, the final selections in the exhibit are not without controversy and contention. That is, after all, one of the enticing things about playing the game in the first place...the opportunity for disagreement and debate. But the exercise also provides a chance to think about the impact, importance, and significance of the things that we have made... and therefore the consequences of the world we are creating.

**Limitations of the Game**

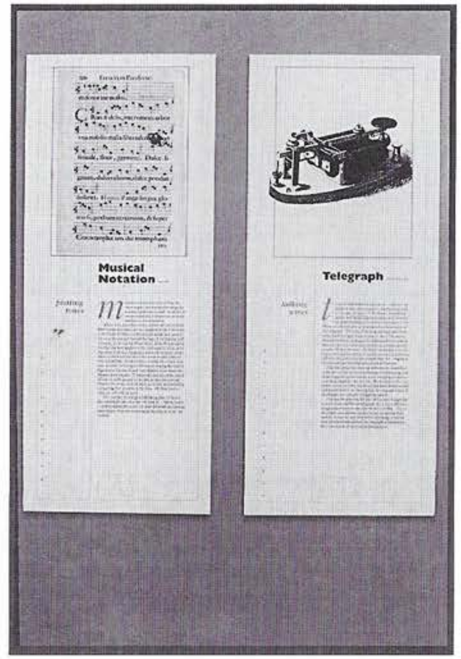
To pick only the 100 Greatest of anything is to struggle with terms and alternatives, and to try to understand what one's criteria and biases are. We hope that visitors to the exhibition -- and readers of this catalog -- will begin to question, just as we did, what design is, the nature of its impact, how what we make has changed the world and our view of ourselves in it, and how we come to value what we do.

Central to this was our growing understanding of the complex relationship between design and social power as reflected in the ability of dominant social groups to finance innovation, write histories, impose values, manipulate markets, enforce production, and so on. Like all human activity, design reflects our inequities.

To take this into account we had to understand our own limitations, and these took the form of a series of centrist biases.

*Anthrocentrism*

Design emerges from many complex systems. The social insects, for example, create elaborate architectures; apes fashion tools; beavers engineer their dams. Even complex natural systems can lead to very specific and intricate designs, as Darwin tells us evolution did to us.



But the human circumstance is different from these other designing systems in its reliance on consciousness and intention and it is this process that is the primary focus of students of design. Therefore, while recognizing that the word design is used for wider systems beyond our own, we included only design by humans for human goals. The exhibition therefore was a sampling of only the universe of the human-made.

*Eurocentrism*

It was nothing less than our advance into the 21st century that inspired this exhibition, yet one of the most profound limitations of this decision was the undeniable Eurocentrism guiding the selections. There were perhaps two reasons for this. First, while many cultures have influenced and even dominated their own time, the past thousand years is marked overwhelmingly by the rise of European culture -- for better or worse -- through its innovation, expansion, industrialization, colonialism. China, Africa, and India are much older cultures whose impact was felt long before 1000 AD. Second, American views of history tend towards a European bias and this leads to a necessarily narrow view. While trying to address this as much as possible, the bias was also part of an unavoidable quirk of history that was reflected in the selections.

*Technocentrism*

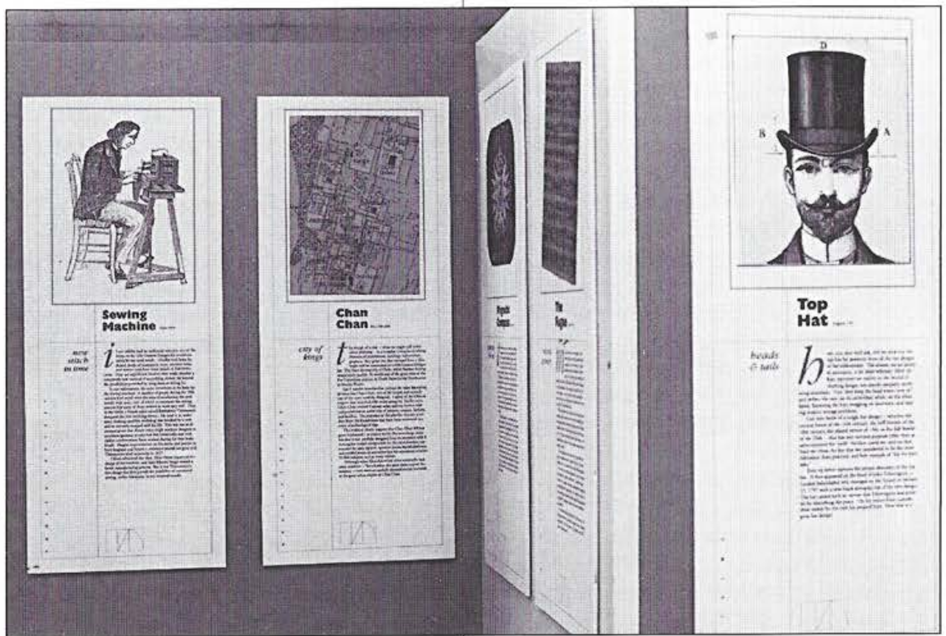
It would be simple to create an entire exhibit of 100 Greatest designs and include only the machines and devices of the last 200 years. Our world is so technocentric that it is sometimes hard to see through the notion that every gizmo since the Industrial Revolution is a major breakthrough. To counteract it to some extent, we created seven categories of design and tried to equalize the number in each. The categories are graphics (designs with largely visual impact), information (designs that organize data in key ways), transportation (designs that move), communication (designs that facilitate interaction), tools and devices (the machines!), architecture (the design of buildings), and living (design for everyday use).

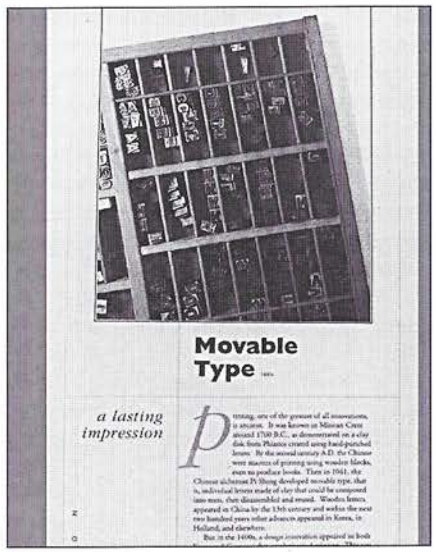
Although this scheme did not solve the problem entirely, it at least addressed the issue to the degree that modern gadgets do not dominate the exhibition.

*Gendercentrism*

One can read through most histories of the world and barely come across the names of individual women. As someone once suggested, this is because history is made by women but written by men. Although said in jest, the role of women in the history of innovation is especially reflective of this problem. The credit for countless designs, no doubt, was taken by men while the names of the women who really created them were lost to history.

But there is another, more fundamental, reason for the gender bias in this and any similar exhibition. In reality, it would be proper to think of design innovation as a team effort... but with one silent partner. Women, particularly since the Renaissance and into the Industrial Revolution, ran the households, cared for the children, handled the finances, managed the food, and otherwise made it possible for the men to pursue their interests. In addition, many of these women/partners also served as idea generators, sounding boards, advisers, co-creators, counselors, and more. In modern terms, women can be seen as the Chief Operating Officers of the cottage innovation industry. And though they may remain nameless, their crucial role must be acknowledged.



# DESIGN: IT'S MORE THAN TASTE

*Martin Holloway*
CHAIR, DEPARTMENT OF DESIGN

**Signposts of Culture**

Most of us would acknowledge that, even if we have no particular interest in art or design, we do have preferences in choosing the man-made objects that are part of our everyday lives. How many of us consider why we make these choices? What might they reveal about aspects of ourselves that are not so trivial as the arbitrary selection of, for example, one color over another?

Our choices of such things as beverages, automobiles, hairstyles, newspapers, and entertainment media point to our differences from one another; in fact these preferences reveal much about our deepest convictions, aspirations, beliefs, and yearnings. And, of course, the symbolic value of design goes well beyond the apparently trivial. The most profound aspects of our lives (religion, education, profession, ethnicity ) all exist in their own encoded worlds of design in which shapes, colors, styles, objects, and the like have specific meaning far beyond personal taste.

In this sense, design has meaning for all aspects of our lives. It is not just superficial decoration, and this makes it a legitimate field of cultural study. As a provider of signposts for understanding culture, design can be seen as compatible with the classic liberal arts.

**Expanding the Definition of Design**

Conventional views of design tend to be limited. The term is frequently used to refer to simply the arrangement of visual components, or perhaps only to a particular professional practice such as industrial or fashion design. Yet the intellectual activity that produces material objects is no different fundamentally from the one that devises a political strategy, creates objectives for an academic course, or writes a musical composition. This is an inclusive view of design that provides a framework for better understanding its essential nature... design is at the heart of devising courses of action aimed at changing existing conditions into preferred ones.

So defined, design is at the core of all activity in which a plan is required to accomplish an objective. Design in this sense is the process of forming; and the forming of visual artifacts is only one example of design. If we view design as the structuring of ideas, events, music, novels, gardens, or inventions, then we obviously cast the activity far beyond the visual arts alone.

**The (Design) Times They Are A-Changin'**

There is much evidence of the changing perceptions of design along these broader lines. There are a staggering number of books now on the market that address historical, theoretical, and critical issues in design; and trade journals increasingly deal with substantive issues in addition to the traditional trade topics and portfolio samplings. Digital technology and on-line communication have democratized both the process and content of design, encouraging design experimentation and exploration of idea dissemination. As a result, designers are now framing their own problems, not just providing solutions to the ones given by a client. Issues of professionalism, accreditation, and licensing are recurring topics for both practitioners and educators; as is the ethical responsibility of the designer to the people and culture impacted by design.

It is not surprising, then, that the body of knowledge necessary for design practice is expanding rapidly. Institutions of higher education are considering five-year bachelors degrees. Graduate-level design programs are more commonplace; and there are even a few doctoral programs in design.

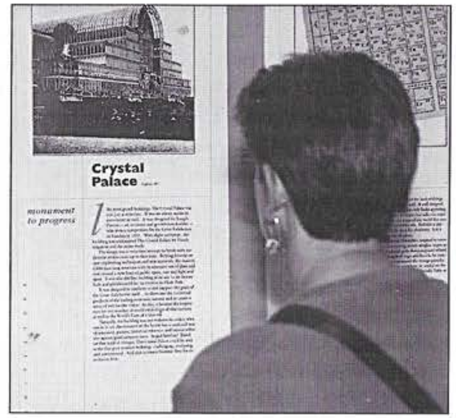
New technologies, reassessment of educational and professional objectives, and responsiveness to social, political, cultural issues are the topics that drive the debate about design today. Expectations of the educated designer are moving from a vocational to a professional mind set; from a presumption of trade school training to an expectation of university education.

This exhibition is positioned squarely in the middle of this dialogue about design. It does not present a doctrinaire position; rather, it offers food for thought. It does not cling dogmatically to a particular view of design; rather it is inclusive. Our hope is that it will encourage the viewer to consider a larger definition of design, and that this consideration will inspire a greater appreciation for all the specific applications of design, visual or non visual.

**The University Setting**

It is particularly appropriate that an exhibition with this intention is being held on a University campus. The campus environment encourages and welcomes all expressions of human creativity, be it painting, music, theatre, dance, creative writing, or design. And the exhibition has itself been designed to stimulate reflection on its subject.

Perhaps most important, the exhibition has been created to appeal to a broad audience, which is consistent with the mission of Kean University, The Design Center, and of the Department of Design. We hope that the objects shown here will provoke discussion and debate among our fellow educators, design (and non-design) students, professional designers, high school students and teachers, parents, and the general public, especially those who have never thought much about design before.



## Bentwood Chair

*Austria, 1959*

*one good seat*

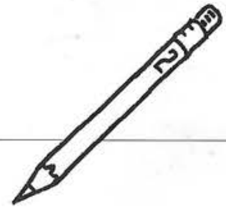
To understand that design is not just about technical problem-solving but about symbolic meaning as well, one need only consider the endless variations on the chair. Chairs are not only for sitting; their designs also have a wide variety of social implications. That is why thrones look like thrones and not armchairs, and why neither look like stools.

A fascinating mix of sculpture, seating, style, and semiotics, a chair would have to be included in any list of great designs. But which one to choose? The fabulous seat of the Sun King? The serene simplicity of the Shaker chair? The innovative chairs of Charles and Ray Eames? Chippendale, Hepplewhite, van der Rohe? With only one slot to allot on a list of 100 designs, we opted for the justly famous bentwood chair designed by Michael Thonet. Around 1830, Thonet invented a technique for bending solid beech staves using steam pressure. What he eventually designed and manufactured with this process was a curvy but sleek, light, inexpensive, and very practical item called the No. 14 chair, which quickly became a prototype for modern mass-produced furniture.

By 1990, an estimated 150 million of his classic side chairs had been produced and they, along with many variations, are still in production today. But study it carefully and you will see that the Thonet chair is not just a place to sit down; it is an icon for an idea...the possibility of a moment of rest, repose, repast, or even reflection. It is a good reminder that the lowly chair is design at its loftiest.

## Pencil

*Europe, 1500s*



*greatest of the great?*

Because we chose not to rate the 100 Greatest Designs in this exhibit, there is no #1, top design of the millennium on our list. But if there had to be, by popular consent the pencil would certainly be it. In fact, it has changed so little from its original form and is so timeless in its appeal to a basic human need, that the pencil may very well be the perfect design. The first description of a writing instrument consisting of a piece of lead held in a wooden casing appears in a treatise by Konrad von Gesner in 1565. However, the pencil took a long time to rise to prominence. It never, for example, replaced the quill pen. The breakthrough came in 1795 when Nicholas Jacques Conte first designed a pencil made of graphite which had been ground, formed into sticks, baked in a kiln, then inserted into a wooden shaft, all of which made mass production possible. This is a good example of why the study of design is not limited to planning but includes fashioning as well; the success of the pencil, like many of the designs in this exhibit, depended equally on how well it could be produced. The pencil is not only useful, it has a wide range of appeals...it smells nice, is chewable and portable, feels good in the fingers, makes a delicate scratching sound that echoes the brain thinking, is largely recyclable, won't roll off a tilted desk, can be sharpened, and is the ultimate word, image, and idea processor. It also happens to contain what many consider to be the second most important design innovation of all time...the eraser.

## Brown Paper Bag

*USA, 1883*

*the great unfolding*

So familiar, cheap, disposable – and yet so remarkably functional – it is hard to believe that someone somewhere actually invented the brown paper bag. But in 1883, Charles Stilwell not only created it, he also invented a machine to produce it. The prolific inventor Margaret Knight also invented such a machine using a slightly different method. Stilwell called his design for a folding bag an S.O.S. for "Self-Opening Sack." Certainly there were paper bags before his, but Stilwell's design included two key innovations. First, the sides of his bag were pleated so that the bag could fold flat and stack neatly. Second, it had a flat bottom when opened so it could stand by itself.

The solution is pure paper engineering...the design really relies on a very simple, but clever, pattern of folds and is, in its own way, reminiscent of Japanese origami, although applied to more prosaic needs.

Stilwell's bag was immediately popular, but it did not really hit big until the birth of the supermarket in the 1930s. As you might expect, there was a slight drop in popularity with the advent of the plastic bag after World War II. But environmental concerns and the fact that the paper bag is recyclable, have returned it to its primacy. All of which has made the plain old brown paper bag perhaps the most familiar package design of all time.

## Brassiere

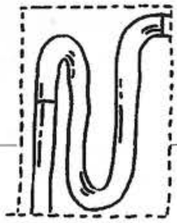
*USA, 1914*

*new means of support*

Question...is the brassiere a great liberating design innovation or just another politically imposed restraint on the female form? Like most designs directed exclusively at women, the brassiere raises all sorts of questions about social power and cultural manipulation. Either way though, the bra has had an undeniable impact on fashion and sexuality that alone nominates it for our 100 Greatest Designs. The actual inventor of the bra is open to question...images suggesting such a *device* appear variously throughout the world. But the first person to patent the idea and produce the particular design that eventually killed off the corset, was Mary Phelps Jacob. She got the idea as a New York debutante fed up with the corsets of the day which were a kind of boxlike armor made of whalebone and cordage that restricted movement and constricted the organs. According to her autobiography, one night before a dance she and her maid devised the prototype for the bra from two pocket handkerchiefs, some pink(!) ribbon, and thread. It was such a success that friends persuaded her to make more and Jacobs eventually went into small-scale production. But the brassiere that she eventually patented did not take off until she sold her patent to the Warner Brothers Corset Company. Typically, the design was worth far less than the ultimate product. Jacobs sold her idea for $15,000, but it was Warner that reaped a fortune by manufacturing and marketing it on a grand scale as the new liberation in female undergarments.

## Stink Trap

*England, 1775*



### *banishing the foul*

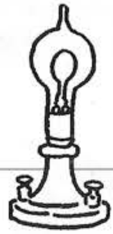
We would be sorely remiss to have a Greatest Designs list that did not include some reference to that truly great modern invention...the flush toilet. Flushing toilets had actually been around for thousands of years, dating back to the Minoans. Yet in spite of their advantages over chamber pots and outhouses, they failed to catch on until a flood of designs appeared in Europe throughout the 18th century. From that point on, too many variations make it almost impossible to single out any one for design posterity.

But there was one particular innovation – so utterly simple and dramatic – that it changed the course of toilets for all time. It came in 1775 from a British mathematician and watchmaker named Alexander Cumming. What he added to his toilet design was nothing more than a simple bend in the draining pipe, a tiny design change with vast implications.

This so-called *stink trap* was able, in his words, to "retain a small quantity of water to cut off all communication of smell from below". In other words, the U-shaped bend always kept a small amount of water in it and this effectively separated the toilet from the air of the sewage or septic tank. The stink trap banished forever the odors of the cesspool from going back up the pipe to the toilet. Simple as it seems, this is the single most significant design change to finally secure the triumph of the flush toilet over all other systems.

## Light Bulb

*USA, 1879*



### *a bright idea*

Contrary to myth, Thomas Edison did not invent electric light. Scores of inventors all over the world were already trying to "subdivide" electric arc light; that is, reduce its brightness for use in the home. Edison did not even invent the light bulb; other inventors such as Joseph Swan and Hiram Maxim were already working on it. What Edison did do was to finally make the ideas and designs of all these others work in a practical way, by thinking of the bulb right from the start as one piece in the design of a total electrical system that included dynamos, meters, switches, and fuses.

After months of effort, the final design that Edison and his company came up with for this compatible bulb was based on two key concepts... a coiled filament that would glow brightly (they struggled with everything from platinum to human hair), and a strong vacuum that would prevent the filament from burning up (thousands of hours went into improving their vacuum pumps).

The final, and successful, design change came when they substituted carbon (actually carbonized thread and later bristol board) for the filament. By New Year's Eve of 1880 crowds who had gathered at the Menlo Park laboratory were treated to the first electric lighting display of any millennium. This design for a bulb that would be part of the electrification of a city ushered in a new era of artificial light and indoor life. It also quickly became a symbol for creative insight from that moment on.

## Fork

*Italy, 1000s*

### *a stab at civility*

Although they were introduced back in the first millennium, forks were exclusively kitchen utensils at first. There is some evidence that they were used at table during the Byzantine Empire in the 12th century, but the first clear illustration of their use at meals is in a manuscript from the monastery of Montecassino in Italy in 1022 AD. Even so, most of Europe at the time, even the nobility, still ate with their fingers (or the disastrous two-knife method) until well into the 17th century. It was only then that the fork began to appear at dinner tables, and only throughout upper class society at first.

As with the design history of any object, the form of the fork has changed over time, producing countless variations. Tines, for example, increased from the original two to as many as eight, until the optimum amount of four was firmly established by the mid 1700s. At this point the fork came into its own as the primary tool for eating, not to mention the great symbol of foodware, at least in the West. Chopsticks, while equally innovative and effective (and still favored 2 to 1 throughout the world) date back to 1200 BC, spoons are even older, and knives far more ancient than that. And so it is the fork that has come to represent the great millennial design for getting morsels to the mouth carefully and deliberately, and for slowing down meals enough to bring small talk and etiquette to the tables of the world.

## Spectacles

*Italy, 1280s*

### *a new view of things*

The first written reference to eyeglasses occurs in the "Opus majus" of Roger Bacon in 1268. Although it is still hotly debated among historians, most evidence suggests that a glassmaker named Salvino Armato was the first to actually design a pair of eyeglasses in Pisa sometime during the 1280s. No record of the design exists, only accounts of a demonstration. But the description is of placing two lenses in a frame that could be worn over the eyes. Whether by Bacon, Armato, or someone else, the whole idea of using glasses to improve vision was based upon recent translations of the optical theories of the brilliant Islamic scholar Ibn al-Haytham from about 1040 AD. It is a simple design concept, but one that dramatically altered the opportunities for reading and may well have created the impetus behind the print revolution of the 15th century.

For a century after their first appearance in Italy, the new "disks for the eyes" were convex and aided only the farsighted; concave lenses had to wait for the improved grinding techniques of the 1400s. (The world *lens* is derived from the Italian for lentil, whose bulbous, round shape early lenses resembled). Early eyeglasses were held in place by hand, no doubt like the original pair in Pisa.

Besides improved lenses, the next biggest design innovation did not arrive until the 18th century, when the various straps, cords, clips, and clasps for holding them in place were replaced with rigid arms that looped over the ears.

## Frisbee

*USA, 1959*


*flight of fancy*

It is a beautifully simple design that takes advantage not only of the limitations of plastic injection molding and complex aerodynamics, but of everyone's sense of the romance of flight. To watch a frisbee hover in the air is to see the dance of physics in action. It also helps that the frisbee happens to be great fun to play with.

The original design for a flying disk toy was created by Walter Frederick Morrison in response to the flying saucer craze of the 1950s. By 1957, his invention was being produced in plastic by the Wham-O Company of San Gabriel, California. To expand sales of the toy, company president Richard Knerr went on a promotional tour of Eastern college campuses. But when he arrived at Yale University in Connecticut, he was surprised to find that students were already tossing around flying metal saucers. They called these *Frisbies* in honor of the local pie company that made the metal pans.

With a few key design changes – a heavier plastic for durability, a ring of ridges around the top and a curled lip around the edge that both improved stability – the now renamed Frisbee was trademarked in 1959. It quickly became and remains an international fad. Who says that a design can't be frivolous and still be great?

## Playing Cards

*1100s*

*working at play*

Cards – that is cuts of paper with symbols on them – are mentioned as early as the Tang dynasty in China in the 10th century. Subsequent centuries saw a proliferation of this idea throughout the world in the form of money cards, picture cards, alphabet cards, flower cards, and many other applications used for gambling, for divination, or in education.

But the most popular variation on this theme – a deck of 52 number cards divided into four suits – probably made its appearance in the 12th century in Europe. While the distribution of number and picture cards in such a deck was settled early on, the familiar hearts, clubs, spades, and diamonds arrangement was only established in France by the 16th century after many other ideas were tried.

It is perhaps a tribute to the human design impulse that even this very basic scheme has led to endless transformations and interpretations. As is true in the case of any designed object, the variety of design possibilities for a deck of cards is truly staggering; hobbies, auctions, and obsessions are built around this fact. Yet as an overall design for a system of play, a deck of cards is hard to beat. The 52 numbered cards in four suits have become the basis for countless games of chance and skill, hours of diversion, and fortunes won and lost. As a result, playing cards themselves represent an unparalleled design innovation.

## Tin Can

*England, 1810*

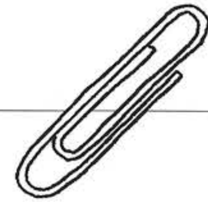
*the fine art of storage*

Although ideas for the preservation of foods in a portable container had been around before the millennium, a total design concept that also included sealing and preserving had not. The benefits of such an innovation were so obvious in fact that by 1795 the French government was offering a reward of 12,000 francs to anyone coming up with a workable design. The original solution by Nicholas Appert was to place the food in a champagne bottle, then seal and boil it. But in 1810 a London merchant named Peter Durand came up with the added idea of fashioning a can made of tin-coated wrought-iron to preserve the food. His patent was bought by Bryan Donkin in 1811, who set up a factory to produce the cans.

Some historians suggest that the tin can may very well have made the ensuing British Empire possible by allowing the army and navy to venture further afield without having to rely on increasingly elaborate supply trains, a problem that Napoleon had faced. Naturally, the can also led to an inevitable design explosion as subsequent tinkerers tried to make cans thinner, lighter, stronger, and more easily assembled. Amazingly though, and despite a constant stream of complaints about the difficulty of opening the new device, the first attempts to fashion a decent portable tin can opener – a quest that still continues to this day – did not begin until 1858.

## Paper Clip

*England, 1899*



*gem of an idea*

Before the clip, sheets of paper were typically held together by a variety of pins or clamps designed for the purpose. But by the time spring-wire was being manufactured by the end of the 19th century, the search was on for a clip that would not damage or make holes in the paper. Typically for the history of design, there were hundreds of variations proposed and patented by the turn of the century.

What has come to be known as the Gem paper clip shape was first recorded in the United States in an 1899 patent, but that application was actually for a machine to produce the clip and not for the design of the clip itself. It is likely that the familiar double-looped configuration was produced a bit earlier in England by a company called Gem Limited. Although it took some time to catch on, it is this design that we think of today as the basic paper clip.

As everyone knows, the Gem isn't perfect...it slips, snags, and catches. New designs are constantly being produced using new materials as well as a seemingly endless array of patterns and configurations. But for whatever reason, it is the Gem design that has evolved not simply as the basic form of the paper clip, but as a cultural icon that will not easily be superseded. Form does not necessarily follow function, but occasionally the two become inextricably entwined to create a classic design.

## Chimney

*Europe, 1000s*

*up in smoke*

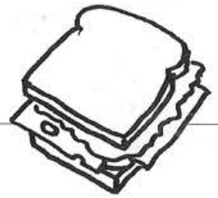
One of the most influential innovations in the design of shelter in the past millennium was not a building but an addition to it. Believe it or not – although specific dates are unknown – it is clear that the chimney was not invented until the second millennium, and was not in widespread use until the 14th century. Until that time, the only way to allow smoke from an indoor fire to escape was through a hole in the middle of the roof. This of course was drafty, leaky, and could not be used in the rain or snow.

The new design at first was simply an extension of the roof hole that allowed smoke to escape higher than the roof itself. This created a slight updraft that made rooms less smoky, and allowed for a narrower opening less vulnerable to the weather. With the addition of a flue and a mantle, it also made it possible to move the fire to the side wall of the room.

As obvious as this sounds, the new design revolutionized dwellings and therefore lifestyles as well. By moving the fire from the center to the wall of a house, it changed the use of interior space towards more private activities. With less smoke to contend with, interior decoration blossomed into an art. And by allowing for smaller and more controllable fires that still radiated heat, it led to the notion of private rooms within a home and the new concept of privacy itself. All these changes supported the indoor activities that were emerging from other technological innovations and that would profoundly change the work and life habits of Europe...leisure, reading, paperwork.

## Sandwich

*England, 1762*



*the layering principle*

Lest you think that all design is the result of a high-minded process of rational planning, let us consider one of the great eating innovations of all time. The sandwich was named for a notorious 18th century gambler and rake named John Montagu. Montagu was the fourth Earl of Sandwich and first lord of the British Admiralty during the American Revolution. An inveterate gamester, history records that in the year 1762, Montagu engaged in a 24-hour non-stop gambling spree during which he refused to get up for meals. Instead he ordered sliced meats and cheeses served to him between slices of bread. This arrangement – design, if you will – allowed him to eat with one hand while playing his cards with the other. His contrivance immediately became referred to as a sandwich, and both the name and the strategy have come down to us unchanged.

Although Romans in the pre-Christian era were known to eat a light snack of food between slices of bread called an *offula*, it was the Earl of Sandwich's design alteration using cold cuts that places it firmly on the 100 Greatest Designs list. Admittedly the principle at work – layering of materials for an enhanced effect – seems rudimentary, but that is only because it is so powerful. It has, after all, been used effectively in many great designs like sheetrock, plywood, and even the microchip.

## Pants

*Europe, 1400s*

*a leg up*

Until pants, men covered their legs with a wide variety of stockings or tights, while women tended to be completely covered by any number of fabric wraps, saris, tunics, dresses, and so on. But a clothing design that loosely covered the entire lower body and held the legs separately did not appear in Europe until just before the Renaissance and even then it was still rather rare.

The name *pants* came from the character Pantaleone in the Italian *commedia dell'arte* of the 15th century, who wore an exaggerated version that was tight from ankle to knee but flared out at the thighs. These were a parody of the knickers and breeches that stopped at the calf and were beginning to replace tights; it wasn't until the early 1800s that long pants became the standard style for men around the world. As an alternative for women, slacks – the word comes from the Roman *laxus*, referring to a loose form of breeches – did not become popular until the 20th century.

By far the most popular type of pants worldwide today are blue jeans. They were designed during the 1850s gold rush in California, by a 17-year old immigrant selling tent canvas named Levi Strauss. His canvas overalls proving too stiff for comfort, Strauss began to use denim which was softer. Besides designing a successful shape for the new pants, Strauss also devised a practical pattern for their cutting and sewing, added rivets to the pocket seams to prevent them from tearing, and used a blue dye to hide stains.

## Zipper

*USA, 1917*

*a design with teeth*

You might not think that something as mundane as a zipper would make the illustrious company of our 100 Greatest Designs list. Yet the zipper was the single most common item mentioned in our returned questionnaires. The methods of the past – buttons, laces, ties, hooks, pins, sashes – all have their fans, but they were cumbersome, complicated, and often unreliable. The design that is the zipper is the millennium's great attempt at true closure.

The original device – called the clasp locker – was exhibited at the World's Colombian Exposition in 1893 by Whitcomb L. Judson. This was the first device in which a series of metal teeth with tiny hooks engaged with the spaces under adjoining hooks on an opposing row. But his design was so clumsy and snagged so easily that scores of inventors, many of them women, immediately tried to improve on it. Finally, in 1913, a Swedish immigrant and employee of the Universal Fastener Company in Chicago named Gideon Sundback, redesigned and streamlined a version that was patented in 1917. One of Sundback's most brilliant design changes was attaching the metal locks of the zipper to a flexible cloth backing.

When the B.F. Goodrich company used the device on its rubber galoshes in the 1920s, the name "zipper" was used as a marketing device. And the rest is history. What more can we say...the design of the zipper is so compelling that it even nudged the fascinating Velcro right off the list.

## Top Hat

*England, 1787*

### *heads & tails*

How, you may well ask, did we pick out the top hat for posterity from all the hat designs of the millennium? The answer, we are proud to announce, is by sheer whimsy. After all, hats represent an oddity in the world of clothing design; not exactly necessity mothering invention. True, they keep the head warm (sort of) and deflect the rain (so do umbrellas) while, on the other hand, flattening the hair, snagging on doorways, and causing massive storage problems.

Can you think of a single hat design – whether the conical henin of the 16th century, the stiff bonnet of the 18th century, the absurd stetson of 19th, or the daft bowler of the 20th – that has any rational purpose other than as advertisement for itself? Neither could we, and on that basis we chose the hat that we considered to be the most ridiculous, least practical, and best example of "hat for hat's sake."

Even its debut captures the proper absurdity of the top hat. It first appeared on the head of John Etherington, a London haberdasher who emerged on the Strand on January 15, 1797 with a new black stovepipe hat of his own design. The hat caused such an uproar that Etherington was arrested for disturbing the peace. On his return from custody, three orders for the new hat awaited him. Now that is a great hat design.

## Kente Cloth

*Africa, 1700*

### *weaving an identity*

Kente cloth was developed by the Asante of south-central Ghana in the late 17th century. The cloth has its roots in the long tradition of African weaving that dates back at least three thousand years. But the unique style and dramatic patterns of kente created something new... a fabric that could communicate a graphic identity and in doing so, represent a particular place and time.

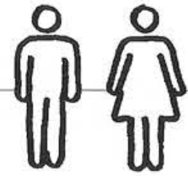
Traditional kente was woven on treadle looms into four to six inch strips which were then sewn together to produce large cloths. This enabled designers to create an incredible variety of patterns that make kente so rich and recognizable. For centuries, Asante and Ewe royalty in Ghana have worn magnificently colored kente of fine silk on state occasions; its popularity as a cloth for the general public is more recent. As in the case of the Scottish tartan, which served much the same purposes of identification and pride, other groups adopted the craft and adapted designs to their own tastes and needs.

But the bright primary colors, expert weaving, and the striking geometric motifs of kente go well beyond the design of fabric for clothing. For one thing, the designs have influenced much of 20th century art; patterns on Kuba textiles from central Africa, for example, informed the work of Gustave Klimt, Paul Klee, and Henri Matisse. More importantly though, Kente has always been and continues to be an iconic material, a proud symbol of African heritage and a vivid graphic representation of uniquely African style and design.

GRAPHICS

## Restroom Symbols

*USA, 1900s*



### *a fine distinction*

Like music and mathematics, graphic symbols illustrate the closest thing we have to a universal language; even being used recently to communicate with other species. Graphic symbols are also among the oldest known human artifacts – appearing in the caves of the Ice Age – and they are the most readily recognized of all human images. Just think of the overwhelming emotional power packed into that infamous symbol of modern evil...the swastika. Or contrarily, the sappy but immediate impact of the ubiquitous happy face.

Clearly this is a category of graphic communications that must be included in any decent 100 Greatest Designs list. And after due consideration of many examples, our choice came down to that most familiar and practical application...restroom symbols.

It is impossible to pinpoint the exact moment when these basic symbols for the male and female form were first created for public restrooms. No doubt it was sometime during the last hundreds years, judging at the very least from the cut of the skirt on the distaff sign. Although, like all such symbols, these images are simplified to the point of self-parody, the two figures have taken on an iconic significance. As is true for graphic symbols and logos in general, their power is in their simplicity and recognizability. Through this, they not only help preserve a widespread cultural practice, they also strike us as so basic and essential that they have come to represent a way that we think about our human condition as binary, distinct, and gendered.

## Italic Type

*Italy, 1501*


### *brave new slant*

Type design is one of the most complicated and challenging of all the design arts; it attempts to balance artistry and expressiveness with clarity and precision. This is not as easy as it might seem and although type designs abound, there are very few great ones. One of the best solutions, and also one of the most enduring innovations, in this arena is certainly the creation of italic type.

It was the Venetian printer named Aldus Manutius (1450 -1515) who first used italic type. He based this slanted letterform on a chancery cursive style of handwriting that was popular at the time. The idea was to create a new typeface that would mimic, suggest, or at least echo the intimacy and personal appeal of handwriting for the new era of the printed book. Most scholars agree that the first book set entirely in italic type was an edition of the works of the Roman poet Virgil in 1501, although there is also some evidence for Robert Wakenfield's *Oratorio*.

In our time, the graceful curves of italic are seen as a bit too tiring to read for an entire book; italic type these days is generally used to set words or phrases off from the rest of the text for emphasis, for titles, or for foreign words. And for this it works quite well.

Despite this limited usage, though, italic type gets our vote for the 100 Greatest Designs list as one of the millennium's classic graphic innovations. Its very familiarity is an example of its success...a simple and elegant gracefulness introduced into printed text that helps capture the nuances of vocal expression.

## Roman Type

*Italy, 1465*


### *from pen to metal*

Roman typefaces are the ones with letters made of thick and thin strokes, and with those small cross streaks at the ends of the letters known as serifs. You are reading one style of Roman type right now called Goudy. Roman typefaces are the most popular typefaces in use throughout the world and include thousands of different variations. But all of these are descendants of the original design by Conrad Sweynheym and Arnold Pannartz, two German printers who were hired by a Benedictine monastery to set up the first printing press in Italy in the 15th century.

Until that time, all printing was done in the gothic textura, or blackletter, style. This heavy, compressed, angular letterform had been the most common writing style in medieval Europe; it was even copied by Gutenberg for the first books printed by his new cast metal technique. To offer a more readable and graceful texture in their printed text, Sweynheym and Pannartz made their design consistent with the Renaissance passion for everything classical. Their new typeface design combined standard Roman capitals with the humanist small letters favored by Italian scribes. They also added serifs to the small letters to match the capitals for a consistent look. The result was an open and flowing typeface, with letters that were easy to distinguish even in smaller sizes. It became the basis for all the serif typefaces we see today.

## Sistine Ceiling

*Italy, 1508-1512*

### *heavenly designs*

It is popular these days to distinguish art from design by suggesting that the former is concerned with self-expression and the latter only with problem-solving. This is a weak distinction, however, since artists are always solving problems just as designers certainly express themselves through their work.

To prove the point, take one of the most famous works of art of all time – the Sistine Ceiling – and consider it as the ultimate design assignment. There was a demanding client (Pope Julius II), a heavy deadline (before the aging Pope passed on), an established rate of pay (about which Michelangelo constantly complained), a struggle with the technology (the challenges of horizontal fresco painting), written copy to work from (the Bible), and the limitations of a given format (the chapel ceiling itself).

In other words, the Sistine Ceiling assignment had all the earmarks of a basic design problem. Add to that all the pure design decisions that were involved in planning, organizing, composing and producing such a complex work in such a challenging space, and you have nothing less than a wonderful example of communication design at its most successful.

Oh yes...the Sistine Ceiling also happens to be one of the greatest works of art of the millennium too.

## Marlboro Man

*USA, 1950s*


### *icon making*

Greatest is not always good, and not all great design is benign. Since design is what we humans do, it necessarily reflects our dual nature...such dreams, such nightmares. The images we create as part of our design obsession, therefore, have a unique power to encapsulate social fantasies and to focus cultural mores like a lens. With this tool, every age develops its symbols of beauty, power, and propaganda.

One of the best examples of this in modern times is the classic Marlboro Man, an advertising image usually considered to be one of the most influential graphic images ever created. The Marlboro Man was invented at the legendary ad agency Leo Burnett in 1954 for the Philip Morris cigarette brand. Their attempt to appeal to the untapped male market (the existing ad slogan called the cigarette "Mild as May") was so popular that the image was featured for thirty years in its advertising campaigns as photograph, illustration, graphic rendering. The image did just what advertising icons do best...it compressed reality into a nugget of fiction. In this case, by representing a certain classic American dream of rugged individualism, tough sensuality, cowboy power and using this to imply that smoking was healthy for your body and soul. (Tragically, and ironically, the original model for the Marlboro Man died of lung cancer in the 1990s.) That this virtual reality helped to hook an entire generation on the drug nicotine only underscores the awesome manipulative power of advertising design.

## The Period

*Germany, 1566*

### *getting to the point*

It doesn't look like much design-wise; just a round black dot. But design is not simply about the look of things, it is about their function too. The secret of this particular dot's greatness is not in the visual form (which is not terribly innovative) but rather in applying it in a new and dramatic way (which is).

Believe it or not, the period as a sentence ender was not set down until the Renaissance. Up to that time, the methods for separating written ideas on a page were a hodgepodge of blanks, slashes, dits, and dashes. Then in 1566, Aldus Manutius the Younger (whose grandfather introduced italic type to printing), defined the use of the period as a full stop in his book, *Interpungendi ratio.*

Although he wrote this treatise as a style manual for printers, what Manutius really did was set down a basic rule for the musicality of prose. His design for the dot called for a way to separate ideas into visual phrases that influenced all prose thereafter, whether in the long symphonic paragraphs of 19th century fiction, or the snappy jingles of modern ad copy.

In 1680 in a book entitled *Treatise of Stops, Points or Pauses*, an anonymous English teacher wrote that a full stop, or period, was "a Note of perfect Sense, and of a perfect Sentence." Surely perfect is one of the measures of a great design.

## Bayeux Tapestry

*France, 1070s*

*weaving a tale*

The Bayeux Tapestry is a 230-foot long fabric scroll on which weavers in the 11th century depicted the story-tale of the famous Battle of Hastings of 1066. That was the battle at which William the Conqueror and the Normans invaded what is now England, defeating King Harold and his Anglo-Saxon subjects. The battle was crucial to European history – and therefore well worth recording – because it established Norman rule over England. This transformed it from a loose collective of earldoms into a centralized feudal society. It also marked the introduction of an entire French vocabulary into the language that would become English.

As historical artifact, therefore, the Tapestry is priceless. And though primitive in style, it is also quite beautiful, embroidered in eight colors to present a regal, formal depiction of the great messy battle. But the design is significant in another way. It was one of the first portable formats (the Tapestry could be rolled up) to use a linear sequence of pictures to tell a story. There are earlier scrolls: the Madrid Codex of the Mayans, for example, which does not use the storytelling form; earlier Chinese scrolls do, but none of these depict a single historical event with such detail. In this way, the Bayeux Tapestry is unique...a kind of ancestor to the comic book, the picture book, and the storyboard, and to all other storytelling formats that attempt to weave a tale through a series of descriptive visual images.

## Helvetica Type

*Switzerland, 1957*

Ra&.

*letter imperfect*

Of the thousands of typefaces that have been created, Helvetica is perhaps the most familiar in the modern world. Naming it after the Latin word for "Swiss", Edouard Hoffman and Max Miedinger designed it for the Haas type foundry in the 1950s with clear open forms and solid lines that would be easily readable in public settings. They succeeded beyond their wildest dreams as Helvetica came to be the most popular typeface, especially when used for signage, all around the English-speaking world. Versions of it have even been adapted for a variety of languages using different alphabets and writing systems.

As a sans-serif typeface (it lacks the crossbar serifs at the end of Roman letters), Helvetica is very much a modern typeface. It presents a strong, solid appearance, and the simplicity of its design also lends itself to a wide family of variations that are all equally readable such as light, bold, condensed, extra bold and so on. In fact, the typeface is so ubiquitous in public signage that it has also come, according to some critics, to undermine its own appeal...to represent bureaucracy itself and perhaps even the cold, calculated manipulation of individuals by corporations and governments. Strong graphic or symbol of control? Probably both. Design being so much a part of our ambiguous lives, this kind of paradox should not be too surprising.

## Coke Logo & Bottle

*USA, 1915*


*the classic package*

The Coca-Cola script is probably one of the most recognizable product logos in the world, yet it was designed by an amateur named Frank Robinson, the company's first bookkeeper. Besides the fancy Spenserian calligraphy, which has been smoothed out and refined over the years, Robinson also came up with the first ad slogan for the product...Delicious and Refreshing. But the immediate success of the logo depended heavily on its appearance on the distinctive Coke bottle. There have been many variations in the design of the bottle throughout the century, but the enduring classic – and the one most people visualize when they think of Coca-Cola – is the curvy vessel designed by Alexander Samuelson for the Root Glass Company of Terre Haute, Indiana. That design – intended to be grippable when wet and to vaguely echo the shape of the cola nut – first appeared in 1915 and versions of it are still marketed to this day.

Together, the original script and bottle are an example of near perfect packaging design... appealing to the eye and the touch, easily manufactured, graphically distinctive, representative of the Art Nouveau aesthetic of its time and place, yet timeless as well.

## Volkswagen Ad

*USA, 1962*


*simpler is better*

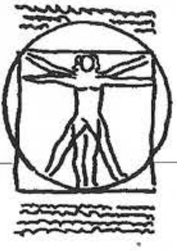
It may seem that an advertisement for a car has no place on a list that includes the light bulb and the Periodic Table. But keep in mind that modern advertising reaches out to and touches the lives of as many people as any product or device. In addition, advertising has the unique opportunity to directly influence the attitudes and behaviors of ordinary folks as much as any other format on our 100 Greatest Designs list.

The Volkswagen ad campaign created by Doyle Dane Bernbach in the 1960s is a case in point. What copywriter Julian Koenig and art director Helmut Krone accomplished with it was nothing less than a revolution in the public attitude towards excess, in both automobiles and advertising. The campaign positioned Volkswagen as a protest against Detroit, both its massive cars and its overheated ads. It defined a new attitude of defiance, consumer revolt, and even contempt for corporate browbeating. It also managed to turn the Volkswagen car into a cult and quickly boosted sales of it up to half a million a year.

The Volkswagen ad campaign not only changed attitudes towards cars, it also had an effect on advertising itself. In fact, it initiated a new era in marketing campaigns that were more direct and visual, less talky, less snooty, and directed unapologetically towards the spending potential of a new and vast market base....the average consumer.

## DaVinci Notebooks

*Italy, 1500s*



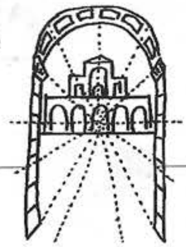
### *ultimate design book*

Most of what we know about the creative output of Leonardo DaVinci comes from the notebooks that he kept throughout his life. The roughly 7,000 pages of these codices that have survived to our time stand as a fascinating example of the creative mind at work and play. They offer a catalog of images, sketches, outlines, words, studies, codes, and plans for all manner of projects and explorations. Here we find designs for buildings, statues, paintings, war machines, gearworks, flying devices, and monuments alongside diagrams showing the flow of water, the orbits of the planets, the structure of the human body and much more. Even the pages of the codices themselves (most of them at least) have been designed with a focused intent...that is, carefully laid out for clear presentation with columns and inset images. This fact, along with the odd reverse writing throughout the notebooks has led to speculation that they were planned to be printed (copies made directly from the pages would print in reverse, making the writing legible) by some method DaVinci devised but never developed.

To DaVinci, the notebooks were a library of his creative ideas. But they have come down to us as something more...the ultimate book on the expression of the design impulse. The pages of the codices exemplify the design process... the urge to view the world, all of it, in every field and form, as a mechanism open to study, analysis, understanding and, of course, redesign.

## Rules of Perspective

*Italy, 1400s*



### *imposing new angles*

Make no mistake about it, perspective is an invention, pure and simple. Although it is so common in Western art that we often think of it as a scientific discovery, it is really a convention. Perspective offers a set of principles or rules for foreshortening of shapes and convergence of lines that gives two-dimensional designs an illusion of space.

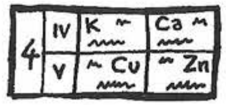
These rules for making flat images appear to have depth that are used so precisely in Western culture were invented during the Renaissance by the architects Filippo Brunelleschi and Leone Battista Alberti, and by the painter Masaccio. Others artists including Leonardo DaVinci and Fra Angelico perfected these mathematical rules for creating the illusion of perspective.

While there are other methods for creating the sense of depth in an image – the overlapping forms that appear in Egyptian art, for example, or the visual hierarchies seen in Persian and Chinese work – perspective is unique in its geometric analysis of visual space and in its ability to seem to place the viewer very powerfully in the depicted space. This is just the kind of design innovation that would appeal to the rationalistic, analytic side of the Western mind. And this perhaps accounts for its extraordinary popularity in the visual arts until well into the 20th century.

INFORMATION

## Periodic Table

*Russia, 1871*




### *charting nature*

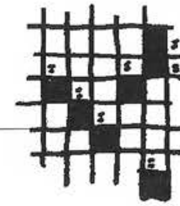
Design is not only about the look of things, but the structure as well. A well designed map, for instance, not only looks appealing (attractive and readable) but tells you something about the shape of the world that you would not otherwise see. And this is precisely what the Periodic Table does for chemistry. It is a map of the geography of the elements.

In 1868, Dmitri Ivanovich Mendeleev, inspired by more accurate methods for determining atomic weights, began to design small, two-dimensional grids that juxtaposed related groups of elements. Using both logic and hunch, he created a variety of charts that represented the strange periodic nature of the elements. Three years later, he settled on the version that became the basic plan for the Periodic Table so familiar to students and chemists today.

The Periodic Table provided nothing less than a new comprehensive view of chemistry that allowed one to visualize the organization of chemicals by atomic weight, the hidden structure of the elements, and the orderly procession of atomic properties. The fact that his design even allowed Mendeleev to predict the existence of elements "as yet unknown," based on gaps in the Table, proved that he had come up with an arrangement that did not just provide a neat visual order, but that actually captured truths about the hidden structure of nature itself. Now that is great design in action.

## Crossword Puzzle

*USA, 1913*



### *a playful grid*

One astounding aspect of design is that it is rich enough to apply to all levels of human needs from the necessity of shelter to the inconsequence of play. In the latter category, there have been a great many design innovations from alphabet blocks to Legos. But among these, the crossword puzzle stands out for the elegant simplicity of its design.

Word puzzles have, of course, been around for millennia; they have even been discovered in Egyptian tombs. But the crossword puzzle is unique; a format not seen until the 20th century.

A crossword puzzle is nothing more than a simple grid to be filled in with the letters of words, separated by black boxes, that provide answers to a list of across and down clues. Who could imagine that so many hours of intelligent amusement might emerge from such a straightforward and self-contained design?

The first crossword puzzle was published in 1913 in the New York World. It had been created rather innocently by a journalist named Arthur Wynne. Yet by 1924, when a little known company named Simon & Schuster published the first book of crossword puzzles, the fad was established (so was the publisher, by the way). Aside from its pure triviality (which alone is appealing), the crossword puzzle is a nice example of the way that a simple design based on a formal structure can lead to a complex activity. In this sense, it is most related to that other rich structure of possibility...music.

## Ivory Ad
*USA, 1882*


### *the personal touch*

Before Ivory was made and marketed, soap was soap...you bought chunks of it in brown paper from the grocer or made it yourself from lye, cooking grease, and table salt. What Proctor & Gamble did was not only produce the first decent commercial version, but begin the empire of advertising and promotion that continues to this day.

It was largely the work of one of the founder's sons, Harley Proctor, that began the whole idea of brand marketing. And his very first advertisement for the product contains all the elements that have become standard advertising ploys since.

The ad takes a generic product and gives it a suggestive name; Proctor got the name Ivory during the reading of a psalm at a Sunday sermon. The fact that the soap floated resulted from a mistake in manufacturing which Proctor instinctively knew gave the soap a unique selling point. This was also the first ad to make a claim (99 and 44-100 per cent pure) that suggested a benefit to the customer. And it speaks directly to the consumer, a completely new idea at a time when ads were thought of as public pronouncements. The first Ivory ad was also designed right from the start to be part of an ongoing campaign that would emphasize a continuing theme (quality).

The idea of brand advertising was so new that there were hardly any venues for it and this ground-breaking ad first appeared in a small religious weekly called *The Independent.*

## Paperback Book
*USA, 1920s*


### *publishing for one and all*

You always know there has been a major design innovation when people start to rail about the demise of good taste. Almost every breakthrough that affects art or literature is met with such opposition. And this was precisely the reaction to the paperback book when it was first introduced in the 1920s, in spite of its immediate success.

This new design for a book resembled the old standard in many ways but two crucial changes made it a revolution in publishing. First, it was a smaller size and designed to be portable. This was perfect for the increasingly mobile workers of the new century. Second, it was printed on cheaper paper and had a soft cover also made of paper. This brought the price way down, while also implying that it was more disposable and not simply meant for the libraries of the rich.

What the paperback did was to democratize publishing and create an enormous new market for writing aimed at the average person and the growing middle class. While the old guard naturally assumed that it would cheapen literature and destroy standards, the new book design is now by far the most common format for publishing. So much so that it is being defended – in exactly the same way – against the onslaught of that newer threat to good taste...the ebook.

## Metric System
*France, 1790s*

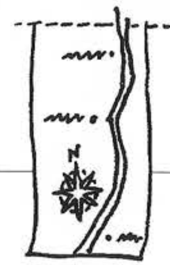

### *a measure of importance*

The metric system was designed by a series of governmental commissions during the French Revolution to address the fact that every province had a different standard unit of length and each trade a different method of measurement.

The idea of a system with a uniform scale of relation all based on the decimal was hotly debated at first, but eventually proposed by the commission and accepted by the National Assembly. The bigger problem was in deciding what a standard unit of length – the first measurement to be proposed – would be. The commission eventually adapted an idea proposed back in 1670 that the basic unit of length would be one ten-millionth of the distance from the Equator to the North Pole (as measured via Paris, naturally). This unit – which works out to just over what we call a yard – would be called a *metre*, from the Greek word for measure. Other basic units for surface, volume, capacity, and weight were similarly negotiated.

The new system took a while to finish. These were, after all, revolutionary times; the chief surveyors were even arrested for a period until the motives for their incessant measuring could be proved. When all the measurements for the new system were finally completed, they were reported to Napoleon in 1810. He remarked, "Conquests pass, but such works remain." Napoleon may have had designs on Europe, but the metric system proved a more lasting innovation.

## Road Map
*England, 1600s*




### *finding one's way*

The first local maps began to appear in England towards the end of the 16th century. The impulse to create them was the result of better surveying techniques and more precise printing technology. But in the 1660s, John Ogilby – probably the most famous mapmaker of the century – added a new design twist to his massive atlas, *Britannia*. This was a complete set of road maps, the first comprehensive accounting of roads throughout England. Although Ogilby died in 1676 before completing the book, the road maps themselves stand as a great design breakthrough.

For the first time, the major roads in each county were displayed graphically so that anyone could follow them. In fact a number of graphic devices were included to aid this usage...compass points were indicated, distances were measured in statute miles, buildings were represented to give some idea of the size of towns, local features were listed to guide the traveler. In other words, Ogilby had invented the idea of the public road map, useable by the average traveler rather than officials and royalty. Not simply a handy guide, this was the introduction of a radical idea...that the country was there for individual citizens and open for their personal travel and use, rather than simply the exclusive property of the landed gentry.

## Globe

*Germany, 1492*

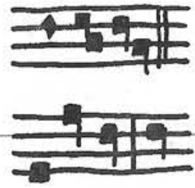
### *a well-rounded view*

Surprisingly, when globes were first introduced they did not have an especially dramatic effect on the mapping of the world that resulted from the Age of Discovery. The reason for this is that their size and shape made them necessarily less accurate and detailed than their flat alternatives, and harder to store. The first recorded design for a spherical map came in 1492 in Nuremberg from a man named Martin Behaim, and for the next fifty years many variations were produced. But these round maps never achieved the popularity of the flat map as a scientific tool. Advances in cartography, geometry, surveying, longitude and other measures, had a much greater impact via flat representations where the details could be reproduced at varying scales. Even though Magellan was known to have carried one on his explorations, globes were more commonly used in university lectures at the time.

Then why is the globe singled out as a great design? Simply because it offers a completely different world view. The advance of the flat map is marked by an evolution in detail and accuracy resulting from more advanced technology. But the globe is a change of mind. The globe offers a view of the earth not as a landscape of endless details, but as a world unto itself, contained and isolated. To generations of students, only the design of the globe has given a sense of what it is like to live on the skin of a ball drifting through the cosmos. An appeal to the poetic over the practical is not a bad legacy for any design.

## Musical Notation

*Italy, 1000*



### *plotting tones*

Musical notation may very well be the most elegant and manageable design for a written code ever created. Its ability to record something as evanescent as music borders on the miraculous.

While there have been many systems devised to write down songs and tunes, the one designed in the 11th century by Guido D'Arezzo, a Benedictine monk, was certainly the most flexible and formed the basis of our familiar staff notation. In lieu of the fifteen letters of the Roman alphabet that had been applied to the notes used in music up to that time, D'Arezzo designed a system of "neumes", shorthand symbols written above the words of each piece to indicate melody. In an attempt to make his system clear and intuitive, he hit upon the idea of making the relative highness or lowness of each note depend on its respective distance from the text. D'Arezzo also introduced the notion of lines or staffs parallel to the text, so that the intervals between the notes could be more accurately determined by comparing their position to the lines. All these innovations are still with us today.

As a corollary to this groundbreaking plan, D'Arezzo also created the idea of a basic six-note set – like an octave – and he named the notes in it after the words in a famous Latin hymn, thus also inventing the familiar do-re-mi convention.

## Newspaper


### *making the news*

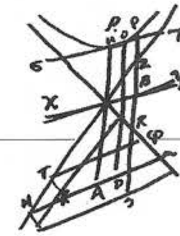
The history of the newspaper is a long and varied story running throughout the millennium, through every country, and covering a wide diversity of formats. One of the most interesting things about this particular design for information -- from both a historical and cultural perspective -- is the amazing variety of forms it has taken that can still all be called newspapers. This includes the bellmen and proclamations of the Middle Ages, the pamphlets, broadsides, newsbooks and *Messrelationen* of the 1500s, the English *corantos* of the 1600s, and many other versions in every society. In fact, the only unifying principle behind newspaper design seems to be the idea of communicating to the general public a collection of printed reports about the events of the day.

Due to this diversity, it is virtually impossible to determine what the first true newspaper was, or what the greatest might have been. But to pick a representative example, we have selected simply the one that is most familiar to modern viewers...The New York Times.

To design a newspaper is to take a collection of stories unrelated in size, significance, and style, and combine them into one format that will make them at once varied but readable, distinct yet coherent, exciting but accessible. The New York Times achieves this with an oversize six-column page, standard Roman typefaces, lean headlines, and carefully cropped photos. This is newspaper design as the ultimate in information management.

## The Calculus

*Europe, 1600s*



### *code of the cosmos*

Of all the many developments in mathematics throughout the centuries, there is one innovation in the past thousand years that calls out for inclusion on our list. This is the system of calculation we now know as calculus.

Calculus was invented during the 17th century – simultaneously it appears – by both Isaac Newton (who was 24 and relatively unknown at the time) and Gottfried Wilhelm von Leibnitz (who was older and already world famous). With slight differences, they separately worked out (designed, that is) the general rules for using mathematics to find the tangent to a curve (differentiation) and the area enclosed by a curve (integration).

Newton, unsure of its significance and effect on his career, deliberately hid his "method of fluxions" in obscure language; his papers on it were only released over time as he became more famous. It therefore fell to Leibnitz, and later to Bernoulli, to popularize and extend the new field.

Calculus took math from static descriptions of the world to dynamic interpretations that allowed things to change, and this eventually had a profound effect on modern science and especially physics. The invention of the calculus also demonstrates one of the most fascinating aspects of design in general...the amazing ability of a sketch, a plan, a scattering of marks on a blackboard – whether for a building, an engine, or a code of calculation – to reach out into the world and change it for all time.

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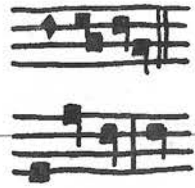

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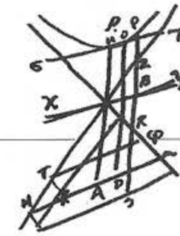

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## Digital Bit

*1900s*

110001
00101
1100

### *the binary basics*

Binary systems of notation in which there are only two elements for representation, are fairly common; they appear in the I Ching, in Mayan calendars, in Morse Code. Francis Bacon created one as a secret code for diplomatic messages in the 1600s. Binary arithmetic, however, is a system in which all numbers can be represented by only two symbols and manipulated through mathematical operations. This innovation is usually credited to Gottfried Wilhelm von Leibnitz, who wrote about it in 1679, but it was developed into a full algebra by George Boole in the 19th century.

By the 1940s, such a system was suggested by John von Neumann as the basis for a digital computing machine. Neumann felt that a binary language would be far more efficient for an electronic device than the bulkier decimal system that was under consideration and, of course, his logic prevailed.

A bit is simply the name given to one of the elements in a binary code – 1 or 0, on or off, flow or no-flow – and as part of a digital electronic system, it is a true innovation. The design breakthrough is not in the look or form of it, but in the way it functions. Today, all forms of communication including text, images, sounds, etc. are translated into bits that can be used and manipulated by computers. This so-called Digital Convergence means that all different types of materials from any medium can be subject to the same rules of computing. It is the idea of the bit – as a pure component of information – that has made computer networks so central to the modern world.

## Book of Hours

*Europe, 1500s*

### *catalog of life*

The idea of combining words and pictures together in book form to enhance the communication of ideas is not as old as one might think. Illustrations to accompany the text of a manuscript are mentioned in Iranian texts of the first millennium, but no example before the 11th century survives. One of the first illustrated books was al-Sufi's *Book of Fixed Stars*, painted at the very beginning of the 11th century, but this was limited in its representation, showing only the positions of stars and constellations along with explanatory text. The ensuing millennium saw the development of the illustrated book in many parts of the world including such famous works as the World History produced in the 14th century in Iran, and the decorated Gospel manuscripts of the 15th century in Ethiopia.

This new design for information reached one of its many pinnacles during the Renaissance in a format known as a Book of Hours. This is the name given to a style of illustrated calendar book that was produced at the time. The text of a Book of Hours usually contained a list of deaths, prayers or psalms, or monthly labors or activities. But of course, one had to be able to read to understand the writing. For the vast majority, it was the visual information that communicated the contents of the book. This included elaborate border designs and pictures of ordinary folks in everyday vignettes, like a catalog of daily life, that could be understood by anyone.

**ARCHITECTURE**

## Gothic Cathedral

*Europe, 1100s - 1200s*

### *reaching to the heavens*

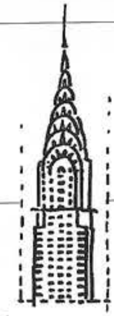
To create a cathedral that would lift the spirit and inspire the imagination, designers in the early part of the millennium came up with some breakthrough ideas. First, they would build it all in stone to last through the ages and to give a sense of permanence. Second, they would remove most interior columns to create a feeling of vastness and to echo the voice and breath. Third, they would replace parts of the walls with stained glass to let in the light and to illuminate images of the divine. And finally, they would make their building thin and tall to elicit awe and reach up to the very heavens.

To accomplish all this, however, required some major design improvements in the structure of the building. In order to create soaring, vaulted ceilings atop narrow stone walls with glass insets, Medieval architects invented a system of external supports. Stone bridges or flying buttresses were constructed that transferred the outward thrust of the walls to stone towers known as buttresses. It was this innovation more than any other that made the soaring structures possible and that made the Gothic cathedral one of the great achievements of the millennium.

Whether as seen in an early example such as the cathedral at St. Germain de Pres, or in the quintessential one at Chartes, or in what is perhaps the most familiar and famous one at Notre Dame, the Gothic cathedral is the place where our design urges have united most dramatically with our spiritual ones.

## Chrysler Building

*USA, 1930s*



### *dream of a skyscraper*

Naturally, any collection of the greatest architectural designs of the millennium would have to include a skyscraper. Part hubris, part romance, and with a dash of flashy engineering magic thrown in, the skyscraper has come to symbolize the city, which itself has become an emblem for modern civilization. For better or worse.

Yet to pick a representative of the form for our 100 Greatest Designs, we surely could not rely simply on height, which is engineering without poetry. Instead, we have chosen one of the most beautiful skyscrapers in the world, a building that is not simply tall but statuesque. The Chrysler building was in fact the tallest building in the world when it was completed. But that distinction only lasted nine months until the Empire State Building was finished in 1931. And it is now dwarfed by buildings in almost every major city that have carried the ideal of the skyscraper to inhuman proportions. But the vision realized in 1930 by the Chrysler building's designer, William Van Alen, was of a tower that would stand for the classy, jazzy side of New York. The building is also a perfect example of the Art Deco style and a unique mix of brick and light, angles and curves. This is the skyscraper, not just as a shelter, but as a monument to soaring dreams.

## Suspension Bridge
*1800s - 1900s*

*a graceful span*

All of the bridges of the world, and throughout history for that matter, have been based on a handful of design strategies for supporting a road over water. Pier bridges are supported by columns set into the river bed, truss bridges by a framework of beams, arch bridges distribute their weight across the span of the arch, cantilever bridges extend over their piers. These ideas, plus a handful of others – enhanced by new materials or combined for added effectiveness – represent the story of bridge engineering. But our vote for the 100 Greatest Designs list goes to another design strategy not mentioned above...the suspension bridge. In this arrangement, the roadway hangs from cables suspended from towers on the shore or from piers at the riverbank. This design allows for longer and thinner bridges an this has resulted in the majestic, sweeping lines that we associate with the most impressive of bridges.

From the very first one built in 1826 at Menai Strait in England, to the most recognizable example – the Brooklyn Bridge in New York, finished in 1883 – suspension bridges have become the most common plan for spanning wide rivers. And perhaps the most dramatic example is the Golden Gate Bridge in San Francisco. Built in 1937 and with a 4,200-foot span, it is still one of the longest and certainly one of the most impressive suspension bridges in the world. A fine example of a minimum of structure to create a maximum impact.

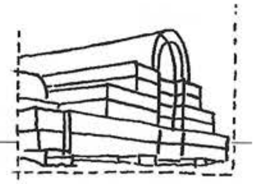
## Taj Mahal
*India, 1653*

*memorial to love*

Besides being a magnificent example of Mogul architecture, the Taj Mahal in Agra in northern India would surely make anyone's list of the most beautiful tombs in the world, if not buildings of any kind. The stunning structure, so familiar and yet still so exotic, has become an icon for Indian culture in general. Partially this status is the result of the physical presence of the building...the white marble, the octagonal platform of red sandstone, the 120-foot high central dome surrounded by minarets, the passages from the Koran that cover the exterior, the pristine and symmetrical pond in front. But buildings tell tales too, and much of the impact of the Taj Mahal relies on the well-known story of its inspiration, built by the Indian ruler Shah Jahan in the 17th century in memory of his favorite wife...Mumtaz-i-Mahal. Her name meant pride of the palace, and when she died Shah Jahan made certain that her memory would live on in stone. His testament to her was constructed over 21 years, by the most skilled craftsmen in India along with 20,000 laborers.

The story, of course, is not merely romantic. For one thing, it has all the earmarks of myth; the grieving ruler was well known to have found consolation weeks after his favorite wife's death in the arms of her young daughter. The tale also points to the power of the wealthy to impose their design fantasies on the world and its people. Yet the ironic result of this inequity, the Taj Mahal itself, stands as proof that design can capture the murmurs of the heart as well as any other form of communication.

## Crystal Palace
*England, 1851*



*monument to progress*

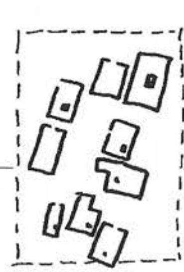
Like most grand buildings, The Crystal Palace was not just a structure. It was an entire aesthetic movement as well. It was designed by Joseph Paxton – an architect and greenhouse builder – who won a competition for the Great Exhibition in London in 1851. With slight contempt, the building was nicknamed The Crystal Palace by Punch magazine and the name stuck.

The design was a conscious attempt to break with traditional architecture up to that time. Relying heavily on new engineering techniques and new materials, the massive 1,800-foot long structure with its extensive use of glass and iron created a new kind of public space, vast and light and open. It was also the first building of its size to be factory built and prefabricated for its erection in Hyde Park.

It was designed to conform to and support the goals of the Great Exhibition itself...to showcase the industrial products of the leading economic nations and to create a sense of awe for the visitor. In this, it became the inspiration for any number of world exhibitions, as well as the World's Fairs of a later era.

Naturally, the building was not without its critics, who saw in it not the romance of the future but a confused mix of ornament, pattern, historical reference, and various other sins against good coherent taste. Sound familiar? Based on that kind of critique, The Crystal Palace could be seen as the first post-modern building... challenging, confusing, and controversial. And that is reason Number Two for its inclusion here.

## Chan Chan
*Peru, 1200s - 1400s*



*city of kings*

The design of a city – what we might call today urban planning – is a complex enterprise involving elements of architecture, sociology, information, graphics. Any great city that emerged from a plan might well be nominated for a 100 Greatest Designs list. The Yuan dynasty city of Dadu, which became Beijing, would easily qualify. So would any of the great cities of the Pre-Columbian empires in South America like Teotihuacan or Machu Picchu. But if not the most familiar, perhaps the most fascinating of these was Chan Chan, one of the largest and certainly one of the most carefully designed. Capital of the Chimor empire that stretched 600 miles along the Pacific coast, Chan Chan covered 9 square miles and was both a royal compound and an active city of laborers, artisans, farmers, and families. The precision of the plan for this city is evident from the foundations that have been uncovered in a series of archeological digs.

The evidence clearly suggests that Chan Chan did not grow haphazardly or evolve slowly like most large cities, but that it was carefully designed from its inception with 9 rectangular walled compounds for the royal families, surrounded by open squares, spacious plazas, burial platforms, and parallel streets to accommodate the movement of some 50,000 residents and as many visitors.

Although other MesoAmerican cities eventually had more residents – Tenochtitlan, the great Aztec capital, for instance – none were as carefully planned to run smoothly as the great urban engine of Chan Chan.

## Angkor Wat

*Cambodia, 1100s*

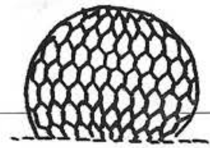
*palace in stone*

Built during the reign of Suryavarman II, one of the Khmer monarchs, Angkor Wat is generally considered to be one of the greatest architectural achievements in the world. It is a monument to the gods, the design of which is intended to serve as a human-made mountain sanctuary.

Dedicated to Vishnu, Angkor Wat is an enormous structure rising 210 feet over the nearby plain. It has a massive surrounding wall and moat, and complex interior spaces, columns, tiers, stairways, colonnades, vaulted galleries, and pavilions. All of this is made of stone and carved with drapery-like decoration and the rich images of deities. A clever system of open colonnades allows the inner walls of the first floor to be bathed in light that illuminates relief panels relating to various Khmer myths. Massive in its forms, formal in its symmetry, yet also delicate in its surfaces and textures, Angkor Wat combines a majesty of volume with a perfection of detail that is unique in the world. And, like so many wonders of the ancient world, Angkor Wat proves that you do not need the technology of industrial machines to build on a monumental scale.

## Geodesic Dome

*USA, 1954*



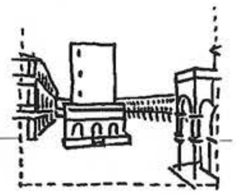
*purity of form*

The name associated with the geodesic dome is Buckminster Fuller. The structure was part of what Fuller called at the time his "dymaxion approach to design." He created the word dymaxion from a combination of dynamic and maximum. Alone among designers in the 1950s, Fuller was looking into building designs that used tension and compression to create lightweight but high-strength structures. He found the perfect solution to this problem in a geometric arrangement of triangular and icosahedral supports with an external skin.

Fuller did not invent the geodesic pattern; this is a common structure found throughout nature. Nor did he create the idea of the dome, which is as antique as the igloo. What he did do, however, was to get the first patent for a building framework based on polyhedron shapes forming a spherical overall shape. This idea led to a structure that enclosed a maximum volume with a minimum weight and amount of material, thus fulfilling his "dymaxion" goal. The geodesic dome failed to catch on as a basic building structure as Fuller hoped it would. But because it allows for a large open space with no obstructions, it has chiefly been used in exhibition settings and arenas. And since its strength comes from its geodesic structure and not its skin, the dome can carry a thin outer covering and be lit to create a beautiful translucence. These properties make it a unique architectural design that perfectly mixes structural integrity with visual beauty.

## San Marco Square

*Venice, 1094*



*grand open space*

To design a great public square you need a generous amount of open space, an intriguing enclosure around it, plenty of sunlight, water, and a city people want to visit. All of these are present at the Piazza de San Marco in the city of Venice. The huge square is bordered by shops and stalls and landmarks: The Cathedral of Saint Mark, an example of Byzantine architecture; the Doge's Palace with its Italian Gothic style; the Old and New Procurate, which are Renaissance buildings: and the Campanile, the bell tower that casts its shifting shadow across the square. All these serve to make the enclosure of the square both varied and interesting, while still providing a generous sense of openness, and also allowing access to the churning waters of the Grand Canal.

Occasionally the problem with a great design is success itself, and this is the chief criticism of San Marco Square in modern times. The number of pigeons and tourists drawn to it because it is so well designed have turned it into a bit of an ordeal, especially in the summer months. Yet as a design to address the challenges for creating an urban open space, for enclosing crowds, and for energizing a city, San Marco still stands as a successful example.

## Eiffel Tower

*France, 1880s*

*engineering fantasy*

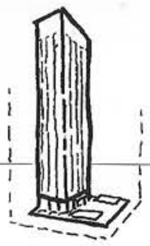
After the zipper and the pencil, the Eiffel Tower was the most common selection among the designs suggested on our 100 Greatest Designs questionnaire. This is no doubt due to its absolutely unique look that is part bridge engineering fantasy and part industrial cathedral. These factors also account for the fact that the Eiffel Tower is probably the most recognizable building in the world.

It was designed by Gustave Eiffel for a Paris exposition in 1889. Following the examples of earlier expositions, the tower was intended to show off the latest in technological marvels. Eiffel's skinless wrought-iron skeleton was a 984-foot spire that was the tallest human-made structure on earth at the time. It was designed right from the start to be a major tourist attraction with viewing platforms and restaurants, and succeeded immediately; its construction cost of $1,000,000 was covered in the first year of visits. It is still one of the most popular tourist sites in any country.

Like the zipper or the pencil, the Eiffel Tower seems so unique, definitive, and so perfectly functional that it strikes us as the only possible solution to the problem. It is not of course, but that immutable feeling is one of the powers of any great design.

## Seagram Building

*USA, 1958*



*the modernist ethic*

The distinctive 38-story office tower designed for the Seagram company by Ludwig Mies van der Rohe in 1958 has come to represent the ultimate modernist building. Modernism was the design movement that sought to eliminate the ornament and detail of industrial production and pare things down to their functional essentials. "Less is more," was one of van der Rohe's dictums, and he pursued this notion in all his designs from office buildings to drinking tumblers.

The Seagram building, like so many other skyscrapers that followed, is essentially a glass box. Gone is the elaborate facade, the ornate detail, the rich front to the world. This is building compressed to its most minimal impression. Modernism is a quest for basic truths, grand narratives, one answer for all...and this building has come to represent its ultimate architectural statement.

The Seagram building is not all cold calculation, however. The steel framed structure is wrapped in a curtain wall of pink-gray glass; spandrels, mullions, and I-beams are used to modulate the outer surface; the elevator banks are lined with travertine. This is really a Gothic dream realized with classic formality, but its ultimate impact is still uncertain. It is open to question whether the building will, in time, come to represent the triumph of the technological aesthetic over the excesses of romanticism...or the final defeat of style at the hands of industrial man.

## Bronzes of Benin

*Africa, 1500s*

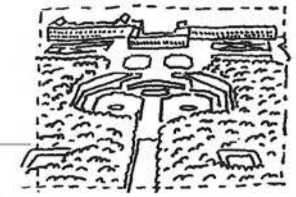
*timeless castings*

Benin was the name of a nation – as well as the name of its capital city – that was one of the most important commercial and cultural centers of western Africa for almost four centuries. Though they had no written language, the Bini designed an eloquent and lasting record of their civilization in the form of a large series of bronze plaques that were commissioned by the king, or *Oba*, to adorn the pillars of his palace. The bronzes are extraordinary in their detail and graphic power, depicting the regal life of the Oba and his court, various celebrations and ceremonies, hunting and war, as well as insights into the ordinary lives of the citizens of Benin. The complexity and intricacy of the work reflects that of the kingdom itself with its sophisticated hierarchies of governors and counselors.

By the time the Europeans arrived in the late 16th century, Benin was already a bustling center for trade with a highly structured monetary system. But with the expansion of the slave trade that followed, the orderly economy of the Bini began to collapse to the degree that by 1897 a British force found the capital city all but abandoned. Even so, the design of the bronzes succeeds as a lasting record of the fashions, styles, governance, and daily habits of a dignified and law-abiding people.

## Versailles

*France, 1660s*



*royal grandeur*

There have, of course, been countless palaces and castles throughout the millennium that exemplify design as a tool of the powerful to defy mortality. But among these, Versailles is unique in its grandeur and excess. When the 23-year old King Louis XIV took over Versailles in 1661, it was still a comparatively modest building and grounds. Over the next half century, Louis and a series of architects expanded Versailles into the archetypal vision of state power, one that reflected both the ambitions of King Louis XIV and of the French empire itself. This was the monarch, after all, who famously said "L'etat c'est moi" ("I am the state").

By the end of the century, Versailles had become one of the most elaborate palaces on earth with its 200-foot long Hall of Mirrors, and its gilded balconies, courts, stables, squares, offices and lodgings, grottos, canals, waterworks (over 1400 fountains). The spectacular formal gardens alone represent one of the most complex landscaping designs in the world and seem to suggest that while a man of wealth can build a palace only a king can reform nature.

Versailles is also the best example of building on such a grand scale as a personal statement of power and wealth. It was intended and used right from the start to feed into the cult of personality surrounding the King, who not only moved the seat of government there, but lived there on very public view...eating, dressing, attending to state matters, and even undressing, for his courtly audience.

In Versailles we have an illustration not of the power of design to change the world, but of the powerful to change design.

## Katsura Imperial Villa

*Japan, 1620s*

*serene retreat*

One of the most fascinating – and to Western sensibilities also one of the most unusual – palaces in the world was built in the 1620s by Prince Toshihito, an advisor to the Emperor of Japan. Katsura Imperial Villa was designed to be a retreat from worldly affairs for a prince who had abandoned politics to devote himself to literature and the arts.

The palace is built in the traditional Japanese style with wooden posts and lintels so that the walls are not load-bearing and can contain wide door- and window-openings. The rooms within the various buildings are modest in size (the largest is only 23 feet by 16 feet), and are separated by *fusuma*, sliding paper-covered screens. This design serves to open the interior spaces onto the lush Japanese gardens that occupy most of the grounds of the palace. The result is a tremendous sense of space that exemplifies that unique Japanese architectural sense of *hashi*, the heightened awareness of the edge or bridge between two boundaries.

There could scarcely be a greater contrast than that between Katsura and the European palaces of the 16th and 17th centuries. With its serene pavilions and simple chambers, quiet tea houses, and lush water and flower gardens, Katsura rejects ostentation and excess in favor of simplicity and serenity. Unique among princely retreats, it is an expression through its design of peace not power.

## Caravel

*1400s*

*innovation on the seas*

The caravel was the basic design for the first great ocean-going vessel. The Nina and the Pinta were both caravels. Like many great designs, the caravel was not so much a new innovation as a great combination of existing ideas. In this case, a new ship was created that included the square-rigged sail, the Lateen sail, and the sternpost rudder. While all of these devices had been invented hundreds of years earlier, probably in China, the caravel designers of the 14th and 15th centuries had the foresight to add all of them to the bulky, wooden ships of their day.

The new design proved revolutionary. The Lateen or triangular sail made it possible for the caravel to sail diagonally to the wind, rather than simply being pushed in the direction of the wind by its square sails. This allowed it to sail more efficiently before the wind and to cover greater distances in less time. The sternpost rudder allowed for greater maneuverability and for a wider ship with a fatter hold. All of this made the caravel perfect for ocean navigation and for the new interest in international trading. This was the ship design that led to the great explorations of the 15th century, to the opening of the first global trading routes and as you might expect on the murkier side, to the age of European colonial expansion.

## Dakota

*USA, 1935*

*ariborne dreams*

Airplanes may provide the best example of the idea that while form and function may go hand in hand, they do not address the same problems. The new aircraft that are designed in each era all take to the air, but they also reflect current aesthetic styles. The Wright flyer of 1906 for example – the first powered heavier-than-air craft – looked suitably Victorian with its double canvas wings, wire struts, and narrow wooden propeller. The Concorde, on the other hand, with its swept back wing and angled nose, fits perfectly into a Cold War space fantasy.

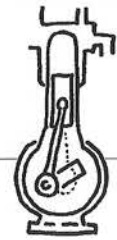
Like cars, all these distinct aircraft have their fans. But our selection for the 100 Greatest Designs list was so successful in its day – so perfect in its merging of form and function – that it virtually started the entire industry of flight. This was the sleek and gleaming, all metal DC-3. The plane was designed by a team of 400 engineers and draftsmen led by Arthur Raymond at Douglas Aircraft. It was created as an improvement over the earlier and smaller DC-2, in response to a growing market for transcontinental travel.

Nicknamed the Dakota, the DC-3 so caught on in the popular imagination that it energized the entire airline business. As the Model T had done for auto travel, the DC-3 made flying both appealing and available to everyone.

The Dakota was first to use a curved aluminum skin that added to its strength and rigidity, and to its lightness. The fuselage and wings merged smoothly, reducing wind resistance. These innovations, along with its very "modern" 1930s streamlined shape, made it an instant classic.

## Internal Combustion Engine

*Germany, 1870s*



*igniting the future*

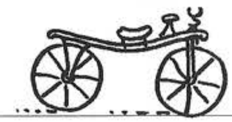
Although an engine using the explosion caused by igniting a gas was built in France in 1860, it was the design by Gottlieb Daimler that would eventually revolutionize transportation.

Daimler's series of designs in the 1870s and 1880s became increasingly smaller, lighter, and more powerful as he continued to improve on the ignition mechanism, compression power, air-fuel mixing device, and the lubrication system of his engine. Daimler's contribution was not in inventing the internal combustion principle or even in constructing its first application. What he accomplished was the refining and redesigning of the engine itself to produce a workable model that could be commercially manufactured.

While others struggled to devise self-propelled vehicles using engines of all kinds, Daimler's primary goal was to design an internal combustion engine that could power factory equipment. After some convincing, in 1886 he did install one of his engines in a horse-carriage. The vehicle attained 10 miles per hour from his single-cylinder, 1.5 hp engine. Not very impressive by today's standards, but this was just the demonstration needed (by onlookers, the press, and investors) to usher in the age of the motorcar. As is true with most revolutionary designs, this one too had an ambiguous outcome. While it transformed mobility, travel, and lifestyles on the one hand, it also created environmental consequences and oil dependency that we are still coping with today. Design revolutions are never pure.

## Velocipede

*France, 1791*



*rolling ingenuity*

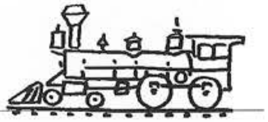
Can it be that no one thought of designing a vehicle with two wheels in a line before the 18th century? So it seems. In spite of some ancient Babylonian and Pompeian bas-reliefs that show devices resembling this arrangement, the forerunner of the bicycle apparently did not make its debut until 1791. That was the year in which the Comte de Sivrac rode a small wooden horse set on two wheels through the gardens of the Palais Royale in Paris, creating quite a stir.

The device had no steering and no pedals; the rider moved by pushing along the ground with his feet and coasting. Yet it proved so captivating that by 1804, races for such *velocipedes* were already being held along the Champs-Elysees.

In time, of course, steerable front wheels, saddles, braking devices, and a wide variety of mechanisms for pedaling and gearing led to an explosion of variations on the theme. Streets of the 19th century were soon filled with Draisiennes, hobby-horses, tricycles, penny-farthings, and then with racers, dirt bikes and so on. But it is the original design in its utter simplicity, for a device on which a rider can sit astride two aligned wheels and move forward, that captures the innovative idea. And that makes the bicycle, to this day, the most common form of transport on earth.

## Locomotive

*England, 1804*



### *engine for change*

The idea of pulling cars along rails originated as early as the 1500s in Europe. Although made of wood, these wagonways allowed loaded carts to be pulled more easily by horses or oxen than on rutted dirt roads. The locomotive – a machine used for the same purpose – came much later, starting with the advent of the steam engine. Since then, almost every source of power – with the exception of nuclear energy – has been applied to the locomotive.

There have been any number of famous locomotive designs in the past 200 years. The first was Richard Trevithick's marvelously stumpy design from 1804 that he called the Catch Me Who Can. By 1829, George Stephenson's slightly trimmed Rocket had reached a dizzying speed of 29 miles an hour. The first diesel locomotive was the Zephyr in 1934, a gleaming stainless steel design out of a Buck Rogers cartoon that inspired the look of diners. And Raymond Loewy's designs in the 1930s introduced streamlining to the style of trains.

But our choice for the exemplary locomotive design is the so-called General, a style that emerged in the 1850s and became the most popular shape for locomotives until the switch to electricity. This is the one seen in so many American Westerns, with its separate engineer's cabin, external oilers, and funnel-shaped steamstack. The design was so familiar until the end of the century that it has come to *represent* steam locomotion in the popular imagination.

## Hot Air Ballon

*France, 1783*

### *flight of fancy*

Some genius of the 14th century, noting that the morning dew rose off the grass when the sun's rays warmed it, suggested a flotation device using dew-filled egg shells. This was a lovely thought but a lousy design. It was not until the 18th century that two prosperous French papermakers named Joseph and Etienne Montgolfier did come up with a practical plan for floating in the air.

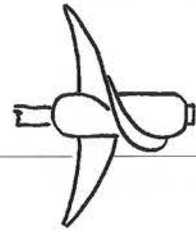
After months of experiments, including sending some terrified animals into the air, their most famous design went aloft in November of 1783. This was a huge 74-foot high balloon made of linen lined with paper, and filled with the hot air from a large fire carried at the base of the bag. This *aerostat*, as they called it, carried two passengers...a young physician named Jean-Francois Pilatre de Rozier and the Marquis d'Arlandes. These first aeronauts floated aloft for some 25 minutes.

Can you imagine the sensation this must have caused as the fancifully painted balloon (another key reason for its selection here) floated five miles over Paris, its passengers waving their cocked hats and scrambling to put out small fires caused by cinders?

It isn't often that romance, art, and engineering meet so perfectly as they did on that day, when the Montgolfier balloon initiated the age of lighter-than-air flight.

## Screw Propeller

*England, 1837*



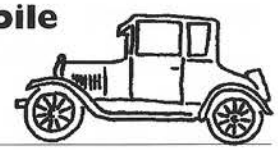
### *pushing water*

By the end of the 18th century, two different designs for using steam power to move boats were being proposed...paddles and jet propulsion. But neither of these was particularly efficient. Then in 1837, Sir Francis Pettit Smith built the first screw-propelled steam launch. The propeller he designed was really a screw drive, a long horizontal shaft around which the screw thread curved like a spiral stairway. It was cumbersome and awkward as a design. Made of wood, half of it broke off during a trial run. But to everyone's astonishment – Smith's above all – this actually increased the speed of the boat. Taking advantage of this serendipity, as good designers always do, Smith quickly realized that it was the propeller's shape not its length that was pushing the water. Thus began a long series of redesigns to find the most efficient propeller shape.

By 1838, Smith had built the Archimedes, named for the Greek scientist who had been an early fan of the screw for other uses, such as pumps. For this new boat, Smith used a flattened screw design resembling the modern version. The success of the boat convinced other designers to scrap their plans for giant paddle-engines and to concentrate instead on propellers. With this, the Age of the Steamship had arrived and it was the design of the propeller that got it moving.

## Model T Automobile

*USA, 1908*



### *the basic car*

Introduced in 1908, the Model T automobile marked the beginning of modern mass production and also served to "Put the country on wheels", as an early advertising slogan promised. In fact, the combination of an affordable and mass-produced car became the impetus for a transportation revolution that still affects us to this day.

When the Model T was introduced, just five years after Henry Ford founded his motor company, there were only 200,000 cars on the road. These ranged in price from $2,000 to $7,500, making them pleasure vehicles for the wealthy. The Model T cost $850 and was engineered specifically for poor country roads. It should not be surprising that 15 million of these "Tin Lizzies" were sold until the style made way for the Model A in 1928.

The car was designed for the factory, not for the showroom. Much of its style was based on getting it through Ford's new assembly line in one hour, rather than on any particular aesthetic concerns. As the company boasted, you could buy one in any color you liked as long as it was black. Yet the Model T is graceful and dramatic and manages in its gentle curves to somehow capture the romance of the road with dignity. For all these reasons – historic as well as aesthetic – it has come to represent the archetypal car, devoid of excessive flourishes, but fulfilling its purpose with quiet style.

## The Quadrant

*Europe, 1200s*

### *sighting the stars*

The idea of using a device to measure angles follows a long story in the history of technology. Medieval scientists used an astrolabe – a complex device made of brass and covered with scales and symbols – for measurements of many kinds both astronomical and astrological.
The quadrant was a much simpler design, and it was this simplicity that made it such an innovative mechanism. The early quadrant was a quarter of a circle made of metal and inscribed with a gauge that measured the angle between a line of sight set along one straight edge and a plumb line suspended from the apex. Separated from the complexities of the astrolabe, the quadrant became a tool that could be more cheaply produced and more easily and quickly used to measure angles for surveying, gunnery, time telling, and navigation.
Increased precision of the mechanism and its gauges by the 16th century, eventually led to a device so accurate that Tyco Brahe could make the exacting measurements of celestial phenomena that initiated modern astronomy. Unlike most of the developments in our sophisticated technology, the quadrant presents a situation in which a simplified design proved to have a much wider application and greater impact than a more complex alternative.

## Magnetic Compass

*China, 1000s*

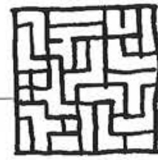
### *pointing the way*

The first reference to the manufacture of a magnetic compass is in a Chinese encyclopedia from 1040 AD, regarding the making of a magnetic needle from a piece of lodestone (magnetized iron oxide). The Chinese also discovered that iron could be magnetized either by stroking it with lodestone or heating it and allowing it to remain stationary while cooled. The earliest design for a compass *per se*, used a sliver of lodestone or magnetized iron floating in a bowl of water. You can't get a more basic design than that. But since the main application of the compass was for navigation at sea, this was soon replaced with a more stable version in which the magnet rested on a vertical pivot, similar to the design we use today.
Two other changes were needed, however, before the magnetic compass could usher in the era of the exploration of the seas and these came from Europe by 1300 AD. First, the compass was set in gimbal rings...concentric brass rings that allowed it to pivot in any direction so that if a ship rolled or tossed the compass would still remain upright. Second was the wind rose...a compass card marked with the cardinal points and subdivisions that allowed mariners to take more precise readings of their positions. By the time of these innovations, the magnetic compass had made the familiar transition from a mere curiosity to a bona fide instrument.

**TOOLS & DEVICES**

## Microchip

*USA, 1960s*



### *diminishing circuits*

Without question, the transistor designed by a team at Bell Labs in 1948, for which they won the Nobel Prize, was a great invention. Their transistor was a miniature valve based on the semiconductor principle, with no moving parts and no warm-up time. It replaced the clunky vacuum tube that was being used in TVs and early computers, and which was constantly overheating and had to be replaced. Since every new invention, besides addressing old problems, inspires a new round of innovation, the transistor also paved the way for the modern electronics revolution.
The first transistor would certainly have made the cut for our 100 Greatest Designs list, except that it has now been incorporated into an extension of the basic principle that has even more radically changed our world. That extension of semiconductor design is the microchip. A microchip is a microscopic collection of millions of transistors and other electronic components, created by etching complex patterns of circuitry in layers onto a tiny chip of silicon. The connections in the standard microchip are currently 900 times thinner than a human hair. And chips in desktop computers are now far smaller than the original transistor.
Chip design – that is, the organization and arrangement of the components and circuits for maximum efficiency and minimum heat – is a design art all its own, perhaps most closely related to urban planning, but on a far vaster and more minuscule scale.

## Wood Screw

*Europe, 1500s*

### *a clever twist*

The design of a screw is so simple and so obvious as to appear timeless. Certainly the idea of a shaft with a spiraling ridge had been used for centuries to raise water, to press clothes, even to torture infidels. But it was not until the 16th century that the familiar design with a slotted head at one end and a tapering point at the other was used as a fastening device for wood.
Wood screws were originally hand-fashioned out of iron and were, therefore, expensive enough to be used only by the wealthy. They were only machined cheaply after 1850, at which point they helped to usher in the post-Civil War housing boom.
More durable than nails, pegs, or staples – which can all loosen and pull out over time – the screw design actually squeezes the pieces of wood tighter the more it is turned. It is also efficient to use, requiring only a simple screwdriver to install and uninstall. Although slot shapes, materials, thread styles, and sizes have evolved over time creating the typical cornucopia of alternatives, the basic design for the wood screw has remain unchanged in 500 years. Cheap, effective, simple to use...it is easy to see why the wood screw has become such a basic component of the builder's trade and why it would make any list of great design innovations.

## Mechanical Clock

*1200s*

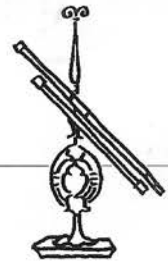
### *the parsing of time*

For much of the first millennium, and even into the second, clocks were run by water. Typically, a vessel was either emptied or filled with water over a set period of time. The obvious problems of evaporation, spillage, freezing, and erosion were not answered until the 13th century with the design of the verge and foliot escapement. (In Europe, that is. As with most cases of innovation, there is evidence of a mechanical clock in China as early as 725 AD, but using a different mechanism than described here.)

The verge was a vertical rod with two small metal flags (the foliots). Suspended on a length of cord or sinew, the verge could twist in one direction and then the other; as it did this the foliots alternately engaged and released the teeth of a gear. With a weight pulling on the gear, this system controlled the speed without relying on dripping water, and thus was the first truly mechanical clock. Like the earlier water clocks though, it had no clockface and was used largely to sound the hours of the day. Use of the pendulum by the 1600s led to more accurate clocks (close to an amazing 5 minutes a day!) and was equally innovative. But the verge and foliot system was the first to initiate our obsession with precision, with increasingly minute divisions of time, and with the entire notion that time is a second-by-second phenomenon. This helped pave the way for an objective science by converting our idea of time from a subjective experience into a construct independent of perception...one reason that historian Lewis Mumford called the clock "the key machine of the modern industrial age."

## Telescope

*Holland, 1608*



### *distant visions*

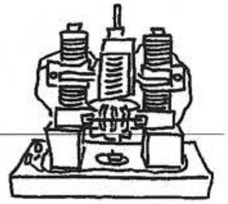
Although certainly invented earlier, the first claim for a patent for a telescope came in 1608 in the Netherlands. It was essentially nothing more than a tube with two lenses. Two years later, the improved instrument that Galileo designed allowed him to make the stunning observations and drawings of the heavens that began modern astronomy. With his rudimentary device, Galileo was able to see the rings of Saturn, the satellites of Jupiter, and mountains and craters on the moon...all with a telescope that magnified only 30 times, less than our modern standard pair of binoculars!

A famous legend has it that Galileo was able to get money to work on his telescopes when he proved to the merchants of Venice that the device could be used to see ships at sea days before they pulled into port, thus allowing for more efficient schedules.

These early telescopes were refractors, with a front lens to collect and focus the light, and an eyepiece at the rear for examining the image. As in the evolution of the microscope, other improvements such as finer and compound lenses, more precise adjustment mechanisms, and reflecting schemes, eventually led to more powerful instruments. As is usually the case, the biggest long-term effect of most design is via the process of revising, reworking, and tinkering with an original idea. On the other hand, the profound inspiration of designing a device that might bring the wide world closer to the eye was right there in the very first telescopic instrument.

## Electric Motor

*England, 1821*



### *powering the home*

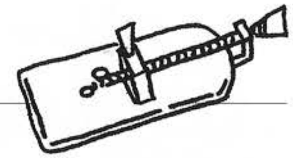
The electric motor that is found in almost everything that plugs in these days began – like the photocopier – not with a complex apparatus but rather with the design of a very simple experiment.

In 1821, Michael Faraday suspended a 6-inch long piece of copper wire from a hook with its lower end dipping into a bowl of mercury. In the center of the bowl was a bar magnet. When Faraday passed a current from his battery through the hook and down through the wire to the mercury, the wire rotated as long as the current flowed. This simple setup with its "electrical rotations" was the first electric motor. Later motors, of course, grew increasingly more elaborate with intricate spools of wire, more powerful magnets, and far more complex mechanisms to convert the electricity into circular motion. It was these devices in their myriad shapes and sizes that essentially brought the Industrial Revolution into the home.

But Faraday's first simple demonstration of the principle proves that design relies as much on the key concept behind an innovation as it is about all the elaborations that follow. Oddly, in spite of his exploration of the basic principle at work, the reverse idea of the dynamo– that a revolving magnet might produce electrical current – was not seen by Faraday or anyone else for over a decade.

## Microscope

*Holland 1600s*



### *the small picture*

The first microscope was undoubtedly a rather unimpressive device. One in use by 1600 was designed by the Janssen brothers of Holland; it was simply a tube 18 inches long and 2 inches in diameter, with a single convex lens at each end. Yet by the middle of that century an improved design with a supporting base and finer lenses was used by Robert Hooke for his book *Micrographia*. It was the book even more than the device itself that spurred interest in the world the microscope could explore and largely for that reason, microscope design began in earnest. Over the centuries this led to larger and more complex devices using more and better lenses, fancier focusing mechanisms, and new and more precise lighting sources...all the way up to the electron beam microscopes of our day.

To select just one microscope for our 100 Greatest Designs list, however, we were drawn to the device designed in 1673 by Anton von Leeuwenhoek. It was a comparatively primitive instrument, magnifying only 500 times. Yet there is something delicate and charming about it. It used a simple and intuitive screw thread specimen holder (user-friendly in modern terms) and an unusually effective double-convex lens (small but functional). With this rudimentary device Leeuwenhoek was able to view – for the very first time – bacteria, plant cells, and other sirens of the world too small to see. Great designs often achieve their greatness less for their engineering than their power to fire the imagination.

## ENIAC

*USA, 1944*

*a big calculation*

The idea for an automatic calculating machine was a fine design challenge met by numerous machinists of the 17th and 18th centuries and culminating in the plan for the steam-powered "analytical engine" of Charles Babbage and Lady Lovelace in the 19th. But their design was never built. Other plans for the addition of electricity to such a machine were also explored into the next century.

It was the secret Army-sponsored project at the University of Pennsylvania called ENIAC (Electronic Numerical Integrator and Computer) that first successfully combined electronics and calculation into one design. And what a design it was...not so much a device as a computing environment. ENIAC was in reality an air-conditioned room containing 3,000 cubic feet of electronic circuitry, 17,468 vacuum tubes, and weighing in at thirty tons. In addition, it could take up to two days to set up the wiring for any particular calculation problem and had to be constantly monitored throughout its computations. This made the basic design for ENIAC more of a human/machine calculating system than a device.

Faster and smaller versions followed, including EDVAC and UNIVAC. And a series of previously classified British computers called Colossus that were used to break German codes during World War II may have predated ENIAC. Still, ENIAC was the first all-purpose computer to use binary logic and electronics for general computation and it is therefore the grandmother of all computers to come. Including, by the way, that microchip in your cell phone which is far more powerful than ENIAC ever was.

## Flintlock

*Sweden, 1539*

*automatic firing*

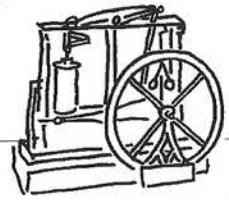
To understand how design can refer to both the visual appearance and the mechanical workings of a made object, one need only consider the history of the firearm with its endless varieties of styles, decorations, shapes, sizes, and mechanisms. Yet one particular innovation in the 16th century made such an enormous difference in firearms that it changed the course of war for the millennium. This was the flintlock, a simpler and more reliable firing mechanism than previously known. In this arrangement, a piece of flint is struck against a hardened steel plate. This creates a shower of sparks which fall onto a pan below and ignite the gunpowder prime. The flash that this creates passes through a small hole in the barrel where it ignites the main charge that propels the projectile.

Although based on the firing mechanism of the earlier musket, the flintlock was designed as a self-contained unit to be smaller, lighter, and to fire more consistently. The earliest record of such a device occurs in Sweden in 1539 and the mechanism was used for 200 years thereafter along with scores of design changes including the addition of sears, cocks, notches, tumblers, hammers, batteries, and frizzens...not to mention seemingly endless variations on the decorative side.

All weapons change both hunting and warfare, but it was the adoption and widespread military use of the flintlock by the French during the 17th century that changed the whole notion of battle from a melee of swords and pikes into an organized shooting gallery.

## Steam Engine

*England, 1763*



*the power of vapor*

Steam used as a form of power had been around for thousands of years. Its expanding pressure had been used to move simple mechanisms in both Greece and China. But it was not until the 18th century that steam was truly harnessed for industrial uses. Ideas for engines that would run on steam power were widespread during the 1700s, with each new version improving on some problem with a previous design. But of all the engines that used steam to move a piston in a cylinder – by Papin, Savery, Newcomen, and others – it was the design by James Watt that had the most substantial impact on the world.

Watt's final design had a number of improvements over earlier versions, including the use of a governor, a spinning device that was the first to provide feedback for regulating the speed of machines. But above all, the Watt engine relied on one fundamental improvement...the cylinder in which the volume of steam was suddenly condensed by a jet of cold water was a separate unit. This separate "condenser" prevented the piston from cooling down with each stroke of the engine and it was this one design change that made the entire engine efficient enough for industrial use.

Watt struggled for years to realize his vision, in part due to the primitive industries of his age which could barely produce good enough components. Yet by 1800, many of the problems were solved and there were already 500 Watt engines at work in England. This was the design that proved to be the true engine of change for the Industrial Revolution.

## Mouldboard Plow

*Europe, 1200s*

*overturning revolution*

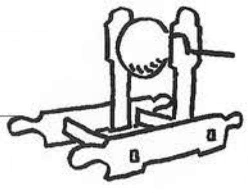
Occasionally an ancient invention gets a small design change – one seemingly minor addition – that leads to an entirely new impact. Such is the case with the mouldboard plow. Plows of various kinds have been used the world over for 8,000 years and no one doubts their importance in the history of agriculture.

But until the second millennium, and despite a number of evolutionary changes along the way, plows did not do much more than scratch the soil. To truly conquer the heavy, damp soils of Europe, a new design change emerged. This was the addition of the mouldboard behind the blade of the plow. The mouldboard was a twisted plank set behind the share (the pointed front of the plow that made the groove) that could slip under the cut soil and turn it over. It was a simple innovation, but with the mouldboard in place previously unworkable soil could now be opened up, and larger tracts of land could be planted. The new design also changed the standard plowing pattern from a crisscrossing checkerboard to a series of parallel furrows, which was far more efficient and allowed for better drainage of the field.

In fact, more than any other invention, it was the mouldboard plow that made the renewed agricultural revolution of the Middle Ages in Europe possible.

## Electrostatic Generator

*Germany, 1672*



### *hints of electricity*

Admittedly, the design does not seem like much. It is simply a ball of sulfur on a hand crank set in a frame with some gears so that it can be turned fast. Yet this plain little device, designed by Otto von Guericke and described in his book *Experimenta Nova Magdeburgica* in 1672, set off a century of discovery with repercussions still being felt.

Rubbing the ball with his hand as it turned, Guericke found that it could attract feathers, linen threads, water. In the dark he could see a glow extending from his hand back to the globe. To Guericke these were both attributes of the strange force called magnetism then being explored, and which he believed to be the very same force that pulled objects towards the Earth. In fact what Guericke had designed was the first machine to actually produce electricity. Other and better designs would follow...the Voltaic pile, the acid battery, the dynamo. But in spite of the fact that Guericke's device generated only a very weak form of static electricity, it still marks an earthshaking breakthrough. It was the beginning of the idea that such a mysterious force could be produced, even harnessed. Guericke's generator is therefore the ancestor of all the devices, gizmos, machines, and designs that – throughout the rest of the millennium – have led to the generation of one of our most basic energy sources.

## Gunpowder

*China, 1100s*

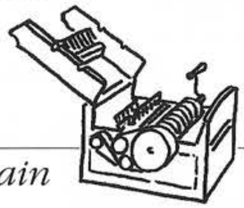
### *an explosive recipe*

Of all the selections appearing on our 100 Greatest Designs list, gunpowder is perhaps the most unusual. For one thing, can it be said to have even been designed at all? It can if you consider the elaborate process of mixing, filtering, boiling, reducing, and crystallizing that was involved in producing just one of its components...saltpeter. This substance when mixed in the right amounts with sulfur and charcoal -- themselves the result of manufacturing procedures -- would explode if ignited. This is surely no simple discovery and if a recipe can be designed, then gunpowder certainly can too. Although known earlier in the millennium, it was not until the end of the 13th century that a book by a man called Mark the Greek offered, for the first time, a useable recipe for gunpowder based on information from China via the Arab traveler Ibn al Baitar. Factories were quickly established throughout Europe. Even so, the choice ingredients, proper proportions, and best methods for production were not fixed until 1650.

The second challenge about including gunpowder on our 100 Greatest Designs list concerns its problematic use for mostly destructive purposes. China being an older and more stable civilization, its invention had less explosive effects on that society; gunpowder was used there as a propellant for arrows and firecrackers; world, we have to take it for both its noble and ignominious effects.

## Cotton Gin

*USA, 1793*

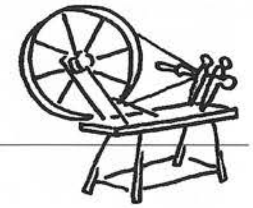


### *an uncertain legacy*

Eli Whitney only spent a few months during one winter designing his cotton gin. It was not a very complicated device. The problem he was addressing was that the Industrial Revolution had opened up a huge new market for cotton across the Atlantic. But the type of cotton being grown in the South, due to its short fibers and tightly clinging green seeds, was very hard to clean. The cleaning then being done, by the slaves of the plantations, was by hand. And this was far too slow to meet the enormous need. Whitney's "engine" was simply a box with two rollers. One was covered with wire spikes that tore the cotton away from the seeds, and the other was covered with bristles that brushed the cotton off the first to prevent clogging. As rudimentary as it was, a slave who could formerly clean only 1 lb. of cotton a day by hand could now clean 50 lbs with the new device. The cotton gin therefore was one of the major influences in the transformation of the region from farming communities to prosperous plantations with plenty of slave labor to efficiently pick and clean the cotton. Not exactly a design made in heaven. On the other hand, it was this transformation that, in turn, paved the way for the Civil War, which precipitated the abolition of slavery. So if you want an example of an important and innovative design with totally ambiguous consequences, you need look no further than the cotton gin's impact on American history.

## Spinning Wheel

*India, 1100s*



### *one more revolution*

Ancient systems for making thread from wool relied on two devices....a distaff and a spindle. The distaff was a cleft stick on which wool was loosely wound. As a continuous lock of wool was drawn from it, it was spun by the fingers and deposited on the spindle, a thin wooden rod with an incision at the top for attaching the forming thread. The spindle revolved by a variety of devices, usually a wooden disc that whirled and kept the spindle turning at a uniform paee as the thread gathered on it. The idea of using a wheel to make the process more efficient did not occur until the second millennium.

It emerged in India as the *charkha* and arrived in Europe by the 1200s, although there is some evidence that it was invented in China at around the same time. At first the spindle was set into a frame and turned by a belt looped around it and around a large wheel, itself turned by hand. The teased wool was pulled through the spindle and pulled taut as it turned. Eventually a bobbin was added to gather the thread, but the familiar spinning wheel turned by a foot pedal did not appear until the 18th century.

This design for a spinning wheel allowed a far greater quantity of useable thread to be produced much faster, thereby supplying the raw materials for a weaving revolution that not only created new industries, but led to the creation of finer fabrics that influenced the style and fashion of the rest of the millennium.

## Sewing Machine

*France, 1800s*

### *new stitch in time*

If our exhibit had no millennial restraint, one of the items on the 100 Greatest Designs list would certainly be the eyed needle. Needles with holes for thread made of mammoth ivory, reindeer bone, and walrus tusk have been found in Paleolithic caves, and are significant because they made possible a completely new method of assembling clothes, far beyond the possibilities provided by tying skins or felting fur.

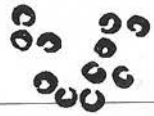
In our millennium, the same innovation is the basis for the sewing machine. A number of people during the 18th century had toyed with the idea of combining the eyed needle with some sort of wheel to automate the sewing process, but none of these seemed to work very well. Then in the 1840s, a French tailor by the nam of Barthelemy Thimmonier designed the first working device. He used it to make army clothing until his workshop was wrecked by a mob and he narrowly escaped with his life. This was not at all unusual given that almost every single machine designed to automate garment production has historically met with violent confrontation from workers fearing for their livelihoods. Despite improvements on his device and patents in England and America, resistance proved too great and Thimmonier died in poverty in 1857.

Others advanced the idea: Elias Howe improved the design of the machine, and Isaac Merritt Singer created a better manufacturing process. But it was Thimmonier's first design that first proved the possibility of automated sewing...to his detriment, to our eventual benefit.

**COMMUNICATION**

## Braille

*France, 1829*



### *points of information*

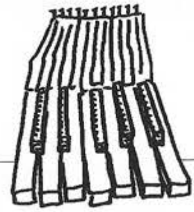
It is not only the objects of the world, but also systems of communication and information that must be designed. Perhaps the best example of this, because it is the most familiar, is the system of raised dots on paper that allows the visually challenged to read text. Relying on a disarmingly simple plan for the representation of letters, Braille is surely one of the most elegant and versatile designs for a simple method of printed communication ever devised.

The idea for such a system first came to Louis Braille when he was a 15-year-old student at the National Institute for the Blind in Paris. He based the idea on a dot-dash code that was punched into cardboard and used by a certain Captain Charles Barbier to send messages to his soldiers at night.

Braille's system, first published in 1829, was much simpler. It used a cell of six dots, just large enough to be distinguished by the sensitive tips of the fingers. From the 63 possible arrangements of those dots, Braille designed a code for the letters of the alphabet, punctuation marks, numerals and, later, even musical notation. It is a clever design for a language code, compact and effective, and can even be printed on both sides of a page since the raised dots on one side do not interfere with those on the other. The recent introduction of an affordable digital reader for Braille ensures that it will continue to be used into the next millennium.

## Keyboard

*Sweden, 1300s*



### *carpet of tones*

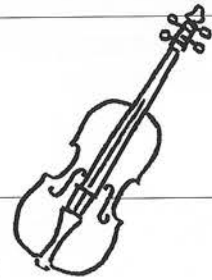
No one knows exactly when the keyboard was invented, but the earliest surviving example dates from the 14th century. That sample is simply a chunky set of keys – almost two octaves worth – that are part of a Swedish organ. This is the first known design attempt to relate individual notes to keys that could be pressed singly or in combination. It is not quite the dramatic carpet of black and whites that we know now, yet the basic idea of whole and half notes arranged horizontally in two offset rows is there.

What changed most dramatically after the introduction of the keyboard was the method by which the depressed key would elicit a sound... whether by releasing air as in an organ, plucking a string as in a harpsichord, striking a string as in a pianoforte, or completing a circuit as in the electronic keyboard.

One might make the case that all musical instruments exemplify great design, and we would certainly agree. Yet there is something beautifully simple, elegant, and instantly appealing about the design of the keyboard. It seems to take the mind, the hand, and the heart into account. In modern parlance, the keyboard has been called the most intuitive interface ever created...so comprehensible and usable that it can be played by both a child and a genius. To create a singsong or a sonata.

## Violin

*Italy, 1500s*



### *making wood sing*

Stringed instruments are, of course, quite ancient and diverse. The notion of stretching gut or string from one end of a stick across a hollow form that would resonate the sound seems to have occurred all over the world at various times. In Europe, the violin is generally traced back to the *rebec*, a bowed instrument of the early Middle Ages with two or three strings and a pear-shaped body.

But the familiar sensual shape of the modern violin only began to appear in Italy in the 1500s as the larger Viola d'Amore. By the 17th century, Nicolo Amati began to produce instruments considered to be of astonishing sweetness and inimitable resonance. In the next generation, this distinction fell to one of his pupils, Antonio Stradavari, who made a larger, flatter model with greater volume and roundness of tone.

With this rich history, the violin has become the quintessential stringed instrument, the ultimate application of design in the service of beauty, and the best example of form and function in perfect harmony. A violinmaker is no journeyman, but a true designer struggling to make wood sing.

Flutists, guitarists, saxophonists, and others who love the design of their instruments will – we hope – forgive us if in the limited space of this list we include only the violin as one of the greatest of all designs.

## Goose Quill Pen

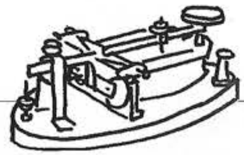
*Europe, 1000s*

### *of words and feathers*

The Latin word for quill is *penna*, and it is from this that we get our word pen. Although there are some references to quill pens before the second millennium, there is no doubt that they did not come into common use until well after 1000 AD. Inexpensive, renewable, recyclable, the quill pen was a vast improvement over earlier, clumsier writing tools for the average person. The quill pen also created a lovely symbolic connection between writing and flying. As usual throughout design history, its success also depended in the ease of its manufacture and early in the millennium an industry developed around the production of quill pens.
This included raising flocks of geese just for their quills and an elaborate process of plucking the quills, then drying, heating, and boiling them in alum and nitric acid to produce an improved quill that would last longer and sharpen better. Crow quills came into fashion by the time of the Renaissance and other species of birds have contributed their wings to the art of writing.
In their day, the design of steel-tipped pens, fountain pens, ballpoint pens, and felt-tipped pens have all left their mark. But there is something about the quill pen that made it special, perhaps in the way it enforced a more reflective, gentler, ornate yet delicate style of writing. And because it was also cheap and portable, and easy to sharpen, it changed writing habits for hundreds of years.

## Telegraph

*USA and Europe 1800s*



### *talking wires*

To prove how fickle success can be – whether via design or any other avenue – one need only look at the case of Samuel F. B. Morse. A mediocre painter and failed Daguerreotypist, with virtually no understanding of electricity or mechanics, it is Morse nonetheless who is remembered as the inventor of the telegraph. The idea of sending messages over wires using electricity goes back at least to the 1750s and it includes hundreds of designs for different devices. Even in Morse's own time there were numerous competing and equally effective devices. Yet Morse eventually won out largely through his ability to use his pro-slavery politics to influence key politicians who helped sway the Congress in his favor and get his telegraphic machine financed.
The first design Morse came up with was an impossibly crude device that relied on a moving stick bouncing over metal ridges for a transmitter, and a swinging pendulum scratching paper for the receiver. By the time of his first public success in 1844, the device had been refined considerably, and there is no denying that the telegraph is one of the designs that radically changed the world.
Our specific selection for the 100 Greatest Designs list is not actually the Morse telegraph, but a more effective design that evolved by the time of the Civil War. This is the simple and efficient tap-key device, so familiar from the movies. It was the ease with which this design could be mass-produced that allowed the telegraph to become the first true system of electrical communication.

## Movable Type

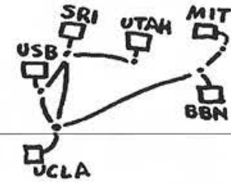
*1400s*

### *a lasting impression*

Printing, one of the greatest of all innovations, is ancient. It was known in Minoan Crete around 1700 BC, as demonstrated on a clay disk from Phiastos created using hand-punched letters. By the second century AD, the Chinese were masters of printing using wooden blocks, even to produce books. Then in 1041, the Chinese alchemist Pi Sheng developed movable type, that is, individual letters made of clay that could be composed into texts, then disassembled and reused. Wooden letters appeared in China by the 13th century and within the next two hundred years other advances appeared in Korea, in Holland, and elsewhere.
But in the 1400s, a design innovation appeared in both Korea and Germany that revolutionized printing. This was the invention of cast metal type. In Korea it developed at the Royal Type Foundry in 1403 and resulted in a book printed in the thousands of characters of the Hangul alphabet. In Germany, it was the result of the work of Johannes Gutenberg. Besides using an olive press mechanism for repeated impressions, Gutenberg also designed a clever, reusable mold for casting letters that also standardized the cast type. This made mass production of printing press letters possible for the first time in the West.
All combined, the various innovations that led to movable type became the first salvo in the great printing revolution that resulted in over a million books printed by the end of the 15th century alone...and on countless books reflecting on the meaning and implication of printed material for humanity.

## Arpanet

*USA, 1969*




### *network dreams*

While no one actually sat down to design the online universe that has become so crucial to modern life, its precursor was a limited online system that can logically make our 100 Greatest Designs list. Arpanet was the name of a small-scale computer communications system created for ARPA – the Department of Defense's Advanced Research Project Agency – in 1969. The innovation of the system was that it allowed separate computers at different locations to transfer information electronically. This was a radical new idea at a time when computers were seen only as isolated machines.
To make the system work, a computer company called Bolt Baranek and Newman, Inc. worked with researchers at UCLA, the University of California at Santa Barbara, the Stanford Research Institute, and the University of Utah to set up the first online computer network. Software applications, transfer methods, hardwiring plans, and computer stations all had to be designed from scratch to accomplish this. Even so, by 1971 there were two dozen sites in the system, and by 1981 more than 200.
The switchover to a new form of information transfer called Transport Control Protocols (TCP) in 1983, allowed the system to expand far beyond its original design. Arpanet itself went out of commission in 1990, but its influence remains as the grandparent of the global online network we have today.

## Bell Telephone

*USA, 1876*

*bridging the gap*

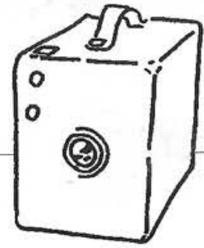
Like any great innovation, the telephone has gone through an entire design evolution throughout its history. And few would deny that this has led to one of the great inventions of the millennium, certainly in its impact on the modern world. But which particular design to select? Unlike radio, which built up by accretion through many decades and the work of many innovators, the basic technology of the telephone has not changed that much since the very first one ever made.

Our choice for the 100 Greatest Designs list therefore is that initial device, the one that Alexander Graham Bell shouted into on that June day of 1875, when his assistant John Watson claimed he could hear "something." Oddly, although audible speech was not actually transmitted with it, that was that very model on which the patent for the telephone was issued to Bell on March 7, 1876. An improved version carried Bell's famous "Mr. Watson – come here – I want to see you," three days later.

The pace of change in the design of telephones started at once, by Bell himself and Thomas Edison and many others, and has never slackened. Many other phones throughout its history have been notable – the Slimline, the Cradle, or the classic Model 302 by Henry Dreyfuss, among others – but it is the very first design, in this particular case, that seems to best encapsulate the spirit of the device...sending a voice over a wire and bridging the gap of distance.

## Kokak Camera

*USA, 1900*



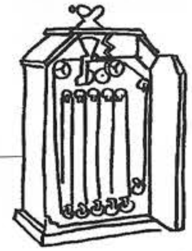
*photos for everyone*

The raw materials for photography – lenses to focus an image and light-changing chemicals – had been around for a thousand years. The *camera obscura* (literally a dark room that allowed an image to be projected onto one wall) was used as a drawing tool during the Renaissance. But it was not until the 19th century that Joseph Niepce and Louis Daguerre in France, and Fox Talbot in England combined these with a method for fixing the image on a surface so that it would not fade in the light, that the camera was invented.

As handsome as those early examples are – not to mention all the Leicas, Nikons, and Polaroids thereafter – our vote for the 100 Greatest Designs list goes to a unique design that first appeared in 1900. This was the Kodak Camera. It was the apotheosis of George Eastman's desire to "make a camera as easy to use as a pencil." The Kodak was essentially a black cardboard box with a film strip (another Eastman invention) at one end and a simple lens and shutter at the other. It sold for $25. Once the 100 pictures on the roll were taken, the entire camera was mailed to Kodak which developed the film, then sent back prints along with a reloaded camera...all for $10. "You press the button, we do the rest," was the ad slogan. This was the design innovation that turned the formerly cumbersome profession of photography into a hobby, affordable by anyone. It exemplifies design in the service of democracy, making a complex technology – and an art form – available to all.

## Kinetoscope

*USA, 1892*

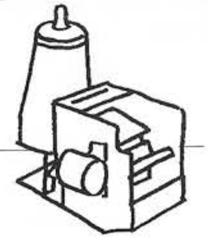


*a very moving image*

There had been many devices for creating the visual illusion of movement throughout the 19th century. Perhaps to compensate for their reception as mere toys, they were given fancy names: spinning disks called thaumaturges, flip books called filoscopes, spinning wheels called phenakistascopes, whirling disks with mirrors called praxinoscopes, and many others. All worked on the principle that if individual images are presented quickly enough, the eye and brain merge them into a continuous moving image. By the time photography was invented in the first half of the 19th century, the search for a means of adding movement was on in earnest. The first commercial motion picture device, however, took this so-called "study of chronophotography" out of the parlor and kicked it into the world of communications media. This device was the kinetoscope, first constructed by William Kennedy Laurie Dickson who was one of the engineers working in Thomas Edison's lab. This cinematic peep-show was a cabinet that held fifty feet of film in an endless loop. A penny placed in the slot started an electric motor that pulled the film under a revolving shutter, and turned a light on as each frame went by the magnifying eyepiece. Disarmingly simple, this was the first design to use photographic film for a moving picture. It also became the precursor for the first movie theater – The Electric Theater in Los Angeles – a few years later and, of course, for the entire movie industry of today.

## Photocopier

*USA, 1940s*



*reproductive work*

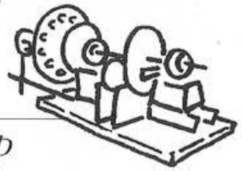
Most inventions are the result of a process of accretion; individuals adding to the evolving design in stages over many generations. Not so the photocopier. In fact, its creator was so alone in his enthusiasm for it that it took him many years to convince anyone else that it had any value.

What Chester Carlson did in creating the photocopier was to design a practical process even more than a mechanical device. Working in his makeshift lab over a bar in Astoria, Queens, Carlson – a chemist by training – tinkered with the idea of using electrical charges to control powdered ink. Because it was dry – requiring no photographic chemicals – the process could be used to make instant "electrophotographic" copies of documents. His very first copy was made entirely by hand using a lab slide, a lamp, and the proper chemicals; with this he managed to produce a smudgy piece of wax paper that said "10-22-38 Astoria."

Having proved that the process could work, he then labored for years over the mechanics of a machine that would apply it in an efficient way. For a long time no one was remotely interested in his invention, until the president of the little known Haloid Company in New York took an interest. By 1949 their engineers had transformed Carlson's homemade gizmo into The Model A, the world's first office copier. The machine was so successful that copiers promptly became the company's main product, and the company's named was changed to Xerox, which meant dry in Greek.

## Whirling Disk Television

*England, 1925*



### *breaking up the image*

Although it is one of our most sophisticated technologies, television is based fundamentally on a very simple design principle...breaking up an image into dots or lines of varying luminescence, converting these into signals that can be transmitted, then recreating the same pattern at the other end.

Modern television relies on a series of very complex improvements, but the basic idea was present – minus the fancy electronics – back in 1925 when a Scotsman named John Logie Baird made the first mechanical television in an attic in Hastings, England.

This contraption used an old tea chest as a base, a tin biscuit box to house the lamp, a puppet head for a subject, spinning disks made of cardboard that held lenses from used bicycle lamps, and power from an old storage battery. It was the spinning lenses that broke the image up into lines, and with this absurd gizmo Baird was actually able to transmit a tiny, shaky image a distance of six feet.

By 1929, Baird had improved his mechanical system to the degree that the British Broadcasting Corporation could transmit short programs over an experimental network. Within a few years Baird was out of business, overtaken by the electronics of Philo Farnsworth and the cathode-ray tube of Vladymir Zworykin, which formed the future of television. But in Baird's mechanical TV we have a home-made design that any decent tinkerer could grasp and that demonstrates a process that would soon become hopelessly complicated to the average person. There is something to be said for designs that make complex processes comprehensible.

## Victor Talking Machine

*USA, 1901*

### *music finds a groove*

The phonograph – the ancestor of all sound systems – made its debut on December 22, 1877, when its inventor Thomas Edison first shouted "Mary had a little lamb" into the sound tube and heard those words repeated back, though almost unintelligibly. In fact Edison thought little of the device at first. He dismissed its application for recorded music, and instead predicted its use in graveyards playing the voices of lost loved ones. Still, as other inventors such as Alexander Graham Bell and Emile Berliner improved his original design for better sound quality, the idea of recorded music began to catch on.

By 1888 a series of devices of different designs called gramophones caught the public imagination. With elaborate sound tubes, simple wind-up mechanisms, and shellac disks turning at 78 revolutions per minute, the gramophone became so popular that by 1903 opera star Enrico Caruso could make a million-selling recording of "Vesti la giubba" from *I Pagliacci*. Other improvements quickly followed of course... motor drives, electronic amplification, balanced needles, and so on. But it is a quintessential gramophone like the Victor Talking Machine – with its delicate crank, swiveling needle, black grooved platter, and brassy sound tube – that not only revolutionized communications and created the pop music industry, but because of the accessible elegance of its design, stands out as the classic sound machine.

## Typewriter

*USA, 1871*

### *making words work*

The design for the modern typewriter included two innovations over the many ideas for "transcribing machines" that emerged in the 18th century. One was an inked ribbon for continuous impressions; the other was simplified parts that could be manufactured and mass-produced. Credit for the first such design usually goes to Christopher Latham Sholes for a rather clunky device that he eventually sold to Remington, the arms company. The commercial version made its first appearance at a 1876 Centennial Exposition, but it failed to find a market for twelve years because it was largely viewed as an outright offense to the fine art of letter writing.

Once it did catch on, however, the typewriter succeeded in creating a new role for the new working woman of the 20th century. Leading to the employment of millions of women, it can be seen as a key instrument in their slow emancipation from the home...or in their enslavement as secretaries, depending on one's viewpoint.

Our specific choice for the 100 Greatest Designs list, however, is the IBM Selectric introduced in 1961. The sleek design by Eliot Noyes was created to "feel like a complete single shape" in spite of the complex technology inside, and to be easy to clean. The typebars and moving carriage were replaced with that amazing feat of engineering...the spinning type ball.

Sholes by the way designed the QWERTY keyboard arrangement based on the frequency of letters used, specifically to avoid jamming. With typewriters now extinct, QWERTY may remain as his greatest legacy.

## Radio

*1800s - 1900s*

### *voices in the air*

Some designs, especially modern inventions, are so complex and evolutionary that they can not be attributed to a single person's creative effort. Nor, because the design is in flux for such a long period of time, to any particular variation on a basic theme. This is design, not by committee, but by succession. The story of radio is a good example of invention as a generational endeavor, slowly and inexorably evolving to fit the needs of the time, and to new developments in the technology.

Contributors to the march of radio included Heinrich Hertz and his copper transmitter, Guglielmo Marconi and his wireless telegraph, Reginald Fessenden's high-frequency alternator, John Ambrose Fleming's diode, Lee De Forest and his amplifier, Edwin Armstrong's superheterodyne circuit, and many others. Each of these added to, improved upon, or refined the basic idea with new designs that would eventually congeal into one of the most powerful mediums of communications in the world.

Our selection for the 100 Greatest Designs list was therefore chosen – by necessity – for stylistic rather than mechanical reasons. It is the so-called seashell design that became popular during the 1930s. Unlike so many radios that were designed to look like other things, this one is purely and proudly representative of the feel of voices in the air, the grandeur of the airwaves. Its the perfect exemplar of the radio simply because it just looks so...radio-like.

THE DESIGN CENTER

The Design Center at Kean University is an educational resource for educators, students, and the general public, focusing on the impact of design on society. Besides its annual exhibitions, The Design Center publishes an annual newsletter called *Ampersand*, creates original products like the TalkChart communications device now used in hospitals nationally, and through its association with students in the Department of Design, provides professional design work for non-profit agencies.
For more information about any of these projects or services please contact:

Alan Robbins, *Director*
908 527-3059

I suppose it is important
to make people feel something,
and if possible, transform
their attitude toward something.

SAUL BASS

EVERYTHING MADE
IS DESIGN, WHETHER
WITH MATERIAL AS
HARD AS GRANITE OR AS
ELUSIVE
AS THOUGHT

PAUL
JACQUES
GRILLO

a design art is a pro-
duction process that
involves the interdepen-
dent development of
goals and a material artifact.

DAVID S. KAUFER & BRIAN S. BUTLER

It is the primary
function of the
designer to be an
innovator

KENNETH
GRANGE

DESIGN IS THE CONSCIOUS EFFORT
TO IMPOSE MEANINGFUL ORDER

VICTOR PAPANEK

Design is
the process
by which we
remake the
world in our
own image

ALAN ROBBINS

the designer
works with four main
elements: materials,
modified by processes,
according to formal
concepts, to fulfill
specific purposes

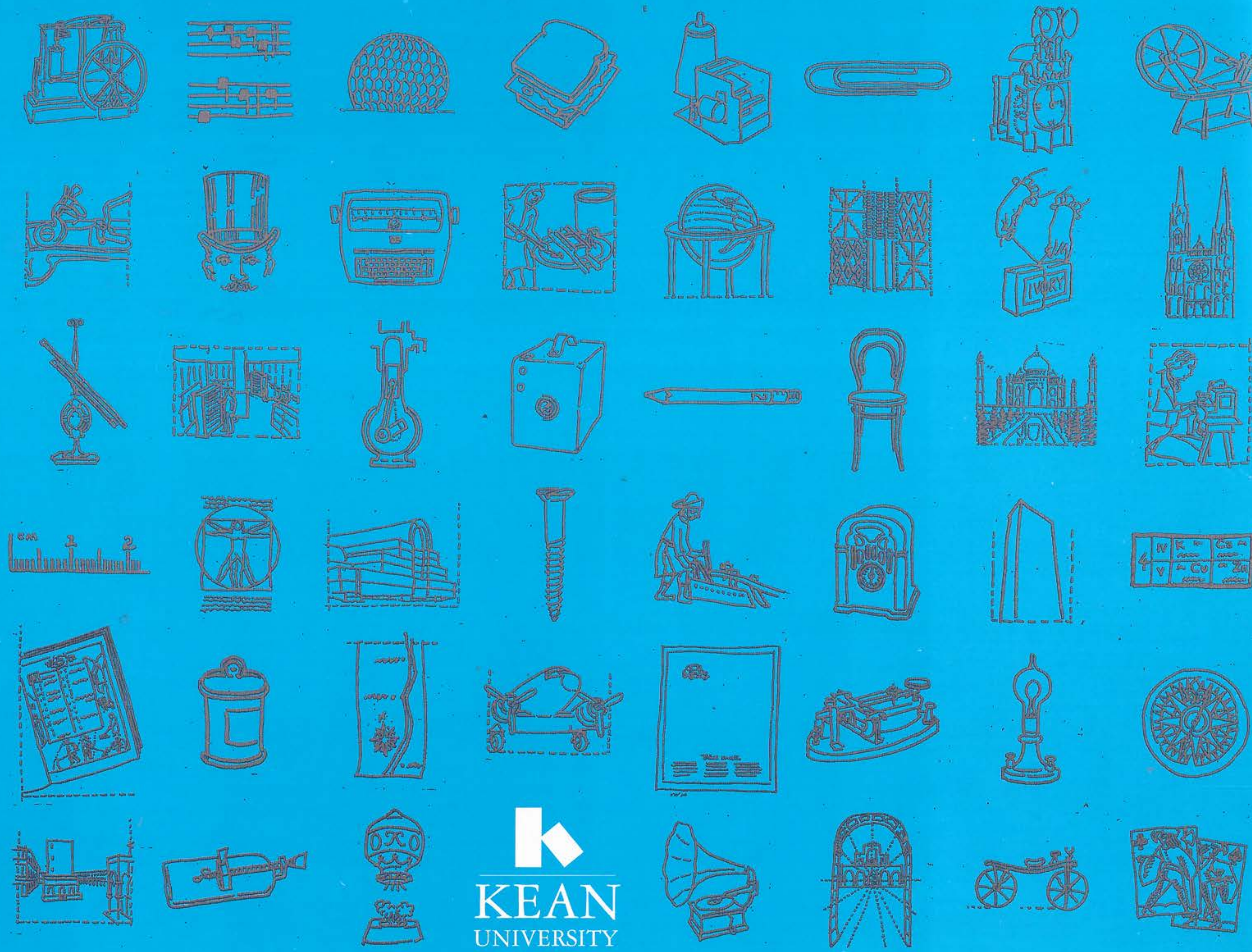
PHILIP RAWSON

all of our arti-
facts reflect
that special
constructive
intelligence
called design

PHILIP RAWSON

The man-
made world,
our environ-
ment, is a
work of art,
every bit of it

DAVID PYE



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