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Rochester Institute of Technology

A Thesis Submitted to the Faculty of
The College of Imaging Arts and Sciences
In Candidacy for the Degree of
Master of Fine Arts in Industrial Design

Localized Manufacturing and the Future of Products

How new technology and the micro consumer market segment will change how products are made.

by Rob Englert 2008

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“The 20th century’s industrial infrastructure has run out of time. It can’t go on; it’s antiquated, dangerous and not sustainable.”

– Bruce Sterling, from *Shaping Things* 2005 (Sterling 131)

Abstract

What has worked for America is that we take in the best ideas and the best people, mix them all up and invent the future.

-Fareed Zakaria, one of *Esquire* Magazine's most important people of the 21st century (Sheff 48)

This paper proposes a new approach to manufacturing products: one that is environmentally friendly, ethically sound and economically viable. Localized manufacturing, and more specifically, Retail Manufacturing (RM) is the concept of retail outlets using advanced additive fabrication processes to print products on demand. RM will streamline many of the steps involved with transporting products to end users. RM will also allow greater end-user participation in the design process, giving consumers more control over product features and aesthetics with a higher level of customization to meet their unique user needs. RM will create and sustain well-paying technical employment opportunities, thus helping to revitalize middle class America. Fashion-oriented consumer products that can be enhanced through custom fits (i.e., in-ear headphones and sunglasses) are excellent candidates for RM. RM will happen; it is just a matter of when.

Globalization, advancing technology, environmental concerns, new materials, and emotion will continue to be relevant to design well into the 21st century. Design has been positioned on the edge of a defining moment; one not seen since the turn of the last century when technology leaped forward with inventions such as the airplane, radio, phonograph, electric light, and the automobile. That technological boom sparked the birth of industrial design, just as current events will shape its future.

Design as we know it is at an important crossroads, and we have to start thinking very differently about our future role to uphold the vitality of our profession in the years to come. A new model is necessary, and it is our duty as designers to reinvent the way products are designed, manufactured, distributed and sold. How are today's advances in materials and technology shaping the things to come? How are current environmental and ethical attitudes going to impact product development? In the face of an all consuming consumer culture, what is the role of design? How has economic policy affected manufacturing methods, here and abroad? Answers to these questions appear in the pages that follow and were derived by documenting the past, examining the present and predicting the future.

This document will begin with an overview of the current manufacturing model. The section that follows will explain how this model evolved by chronicling a brief history of American design and manufacturing. New manufacturing technologies that have the potential to impact the future of how goods are created, bought and sold will then be presented. A series of case studies will illustrate how the consumer landscape is evolving from a "mass" to a "micro" perspective. These real world studies will indicate the growing demand for localized, custom manufactured products, targeted to a demographic of one and the emotional component associated with consumer participation in the design process.

Introduction: Today

Most of the products Americans use today are manufactured on the other side of the globe where there are few environmental controls and questionable labor practices. Many of these products use expensive steel and aluminum tooling to create injection-molded parts. Products are assembled, packaged, repackaged and palletized to conform to the dimensions of the shipping containers that transport them. The goods are then shipped *via* diesel-powered freighters to Long Beach, California where they are loaded onto tractor-trailers, and delivered to regional distribution centers across the country, that are powered by coal burning electricity plants. The products are warehoused temporarily until they are, yet again, loaded onto gasoline and diesel fueled trucks to be transported to various retail outlets that also use energy created by fossil fuel burning power plants. A consumer then purchases the product, takes it home, and then the packaging is removed and tossed into the garbage. The product is used until it is no longer needed, and it too, is thrown away.

This manufacturing/use model has a significant impact on the environment, the economy, product quality, product safety and the consumer. The global economy has adopted a method of production that was never intended to be used in this manner or if it was, we were unaware of the global impact of our actions. For multiple reasons, this model is not working, and we need to develop a new method for manufacturing products. What if there was a way to minimize the waste associated with globalization? Localized manufacturing and RM is the future of producing goods that are environmentally, ethically sound and economically viable. Through the use of technology, material advancement and the micro consumer market segment, RM becomes possible. Imagine many of the retail outlets where consumers now shop as miniature factories creating products without the use of expensive tooling, inter-continental shipping, wasteful packaging or warehousing.

The industrial scenario in modern China paints a close picture to the U.S. from years ago with factories mass-producing everything from salad spinners to cell-phones. Current signs show that the “never-ending” supply of labor is coming to an end. There are currently strong signs suggesting that the once never-ending supply of labor will be coming to a halt. At some companies, labor shortages are causing wages to rise upwards of 40 percent annually. Long work weeks consisting of 12-hour days, 7 days a week and less-than-ideal living conditions (often eight employees sharing a room in a factory-owned dormitory) is getting more difficult for workers to tolerate. Eventually these workers, making on average \$160 per month, will want to more actively participate in their local economy.

Pittsburgh Pennsylvania early 20th Century.



Beijing China today Manufacturing is effecting the environment in developing nations, just as it did here in the U.S. a century ago.





Wal-Mart certainly casts a long shadow. The company is the biggest private user of electricity in the U.S. -- each of its 2,074 supercenters uses an average of 1.5 million kilowatts annually, enough by one estimate to power all of Namibia. It also has the nation's second-largest fleet of trucks that travel a billion miles a year. By Wal-Mart's own admission, its U.S. operations were responsible for 15.3 million metric tons of carbon emissions in 2005. That's more emissions than the countries of Bolivia and Cyprus put together. (Gogoi and Herbst P2.)



Abysmal living conditions in a factory owned worker dormitories are common place in developing nations like China. Peasant workers from the Chinese countryside flock to the industrialized regions of Southern China in the hope for a better way of life.

1,000 workers riot at Chinese factory

Published: THURSDAY, JULY 27, 2006

BEIJING: More than 1,000 workers rioted over poor working conditions at a southern China factory that produces toys for McDonald's and other firms, a U.S. labor rights group said Thursday. The incident began last Saturday when workers at the Hengli Factory in Dongguan, Guangdong Province, protested over meager wages, lack of days off during public holidays and poor living conditions, the New York-based China Labor Watch said.

The protest began in workers' dorms and evolved into a riot that stretched into Sunday, the labor watchdog said in a statement. Many were injured and dozens of workers were arrested, according to China Labor Watch.

An official at the Hong Kong-based Merton, which owns the factory, said there had been an incident but declined to comment on the specific allegations.

Articles such as the one presented to the right have become increasingly more common as workers in developing nations demand more participation in their own economy. (International Herald Tribune)

Factories have made adjustments to compensate for these increases but it is only a matter of time before the rising costs are passed on to the consumer. When sales begin to slip, corporations will further the search for cheap labor, possibly deeper within China or to other, less developed countries.

In my my discussion of mass production in the year 2008, the existing manufacturing/consumer model is formally intact and still being used the world over. However, there is increasing consumer pressure for energy, labor and environmental reforms that demand change. This need for change will continue to grow with each subsequent generation of consumers.

Due to a global consciousness influenced by the Internet and 24 hour a day cable news, there is a new generation of American consumer is emerging. These consumers are environmentally conscious, ethically aware and technologically savvy. They demand products with little impact on the earth, and ones that are not made in a sweatshop. And they want them immediately. They also want products they can identify with, products that fit them to a "T". Companies like Nike and Patagonia realize the potential in this area and have programs that cater to personalization and environmental concerns. Patagonia prides itself on its recycling programs and the fact that it gives one percent of its profits to environmental causes. Both Nike and Patagonia have experimented with mass-customization online and most recently in-store, with Nike's ID Studio (ID stands for Individually Designed).

Will all these factors facilitate the idea of RM, totally replacing the current model completely? Probably not! I propose that many low cost consumables will continue to use the old model and the old model will remain appropriate for some products, such as disposable plastic utensils. RM on the other hand, would be a better approach for mid-range products such as cell phone cases or sunglasses, producing customized goods previously available only to the wealthy.

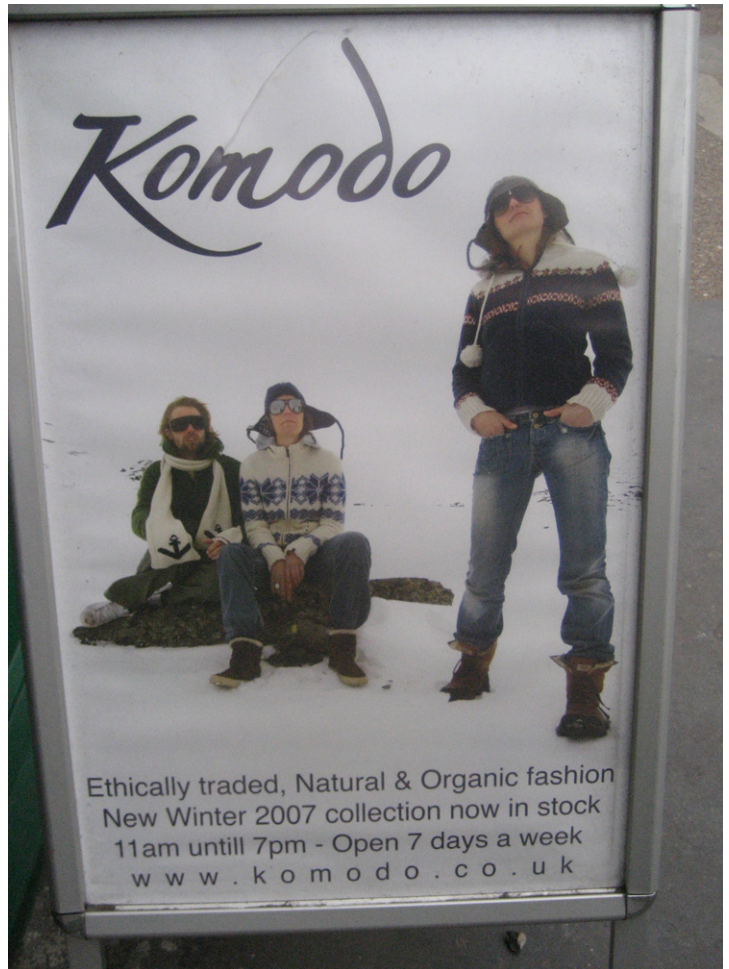


Nike's new Air Jordan basketball shoe showcases its efforts in sustainability and new age craft. The shoe is hand sewn in Italy, uses less adhesives and retails for \$230. Nike realizes that these attributes are not enough to guarantee success and markets the shoe with emphasis on performance.





Consumer attitudes are shifting to more environmental, ethical and local concerns. This shift is more apparent in forward thinking cities such as London where these images were taken.



Origins: How Craft Evolved into Manufacturing.



The dense forests of early America helped shape early American products such as the felling ax and the rifle.

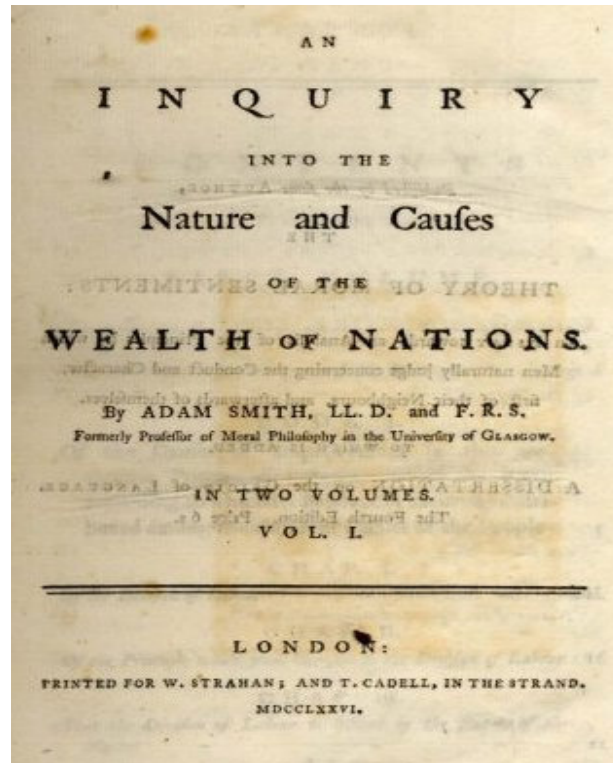
Before we can predict things to come, we have to understand the past.

American design stretches its roots back to its first settler's need for survival in a new, sometimes harsh environment. Many of the early artifacts created in America were born out of pure necessity and self-preservation. When the implements carried over from Europe began to fail, replacements were improved upon. The sheer vastness of the forests in the New World required felling axes with longer, stronger handles than their European cousins. These same thick forests pushed for the development of the increased accuracy of the hunting rifle. Technological advancements fueled by self-reliance and daring ingenuity, combined with entrepreneurial spirit would become the hallmark of design in America.

Likewise, Industrial Design as a profession (in the U.S.) began in the early 20th century, but it is rooted much earlier with the local craftsmen of the Colonial Age. America offered the opportunity to escape the guild system that was in place throughout Europe at the time, giving rise to a creative class consisting of silversmiths, blacksmiths, coopers and candle makers. However, the most highly sought wares were of European design and most artisans imported European goods to both sell and copy. Whether because of Puritan values or shortage of skilled labor, American designed goods tended to be of honest material with little regard to unnecessary ornamentation, which in many ways still holds true today. A true "form follows function" mentality progressed.



Adam Smith's "Wealth of Nations" was a pivotal work in the theory of economics. Free trade and capitalism became the backbone of the newly formed United States of America.



The move toward American independence was fueled by economic reasons as much as religious and political issues. Severe trade and manufacturing restrictions were imposed by the British government out of fear of America developing a self sustaining economy. Adam Smith's views on how economic prosperity is advanced by self interest and competition had a major impact on the early American government. At the first Continental Congress in 1774, it was agreed that products would no longer be imported or exported to or from England. There seems to be some similarities between colonial-era England's fear of losing one of its biggest export markets and today's American fear of losing manufacturing to foreign competition.

*"To promote the Progress of Science and
useful Arts, by securing for limited Times to
Authors and Inventors the exclusive Right
to their respective Writings and Discoveries"*

The U.S. Constitution recognized the need for open innovation to foster competition while protecting invention through patents.



The lack of superficial decoration is evident here in a piece of silver designed by Paul Revere.

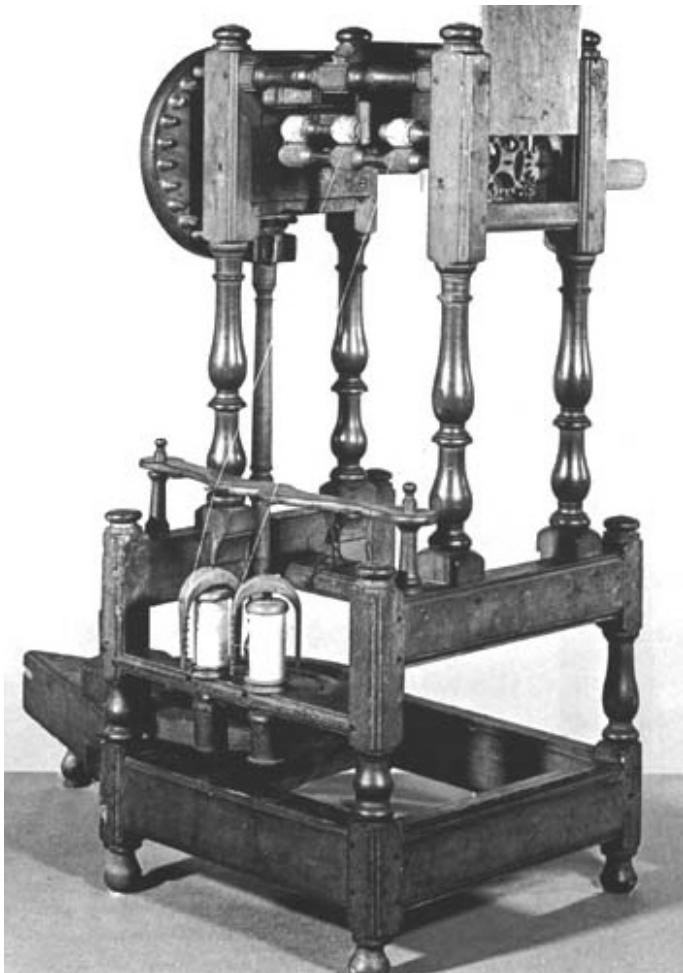


Technology played as big a role in colonial times as it does today and it is a misconception to think of early American artisans as “humble craftsmen employing quaint methods rooted in antiquity” (Pulos 12). It was very common to employ the newest methodologies derived from emerging sciences to increase productivity and efficiency while improving return on investment. American master craftsmen set themselves apart from their European counterparts by sharing knowledge of other “useful arts” such as architecture, ironwork and cabinetry through libraries and trade publications as a way of advancing industry as a whole. This convergence of knowledge allowed American industry to quickly catch up to its foreign competition through manufacture of more complex products, such as carriages, which needed expertise in wood, metal, fabric and decoration.

There was considerable debate over the acceptance of manufacturing. Initially, many founding fathers thought that America should strictly be an agrarian society and take advantage of its abundant natural resources while importing necessary manufactured goods from foreign sources. But it was soon realized that a balance between agriculture and manufacturing was needed to build a self-sustaining, independent nation. The American Revolution became a pivotal turning point in American design history and forced this balance. It wasn’t until after the American Revolution and the adoption of the U.S. Constitution that the seeds of a unified industrial base took root. Independence encouraged the shift from individual “artisanal activity” (Pulos 66) to more collaborative efforts that, through the use of machinery, could increase production significantly. This shift became the beginnings of the American system of manufacture and marks the birth of the earliest American industrial corporations. These corporations provided employment to those who would become their biggest customers, middle class Americans.

The patent system, supported by the U.S. Constitution, proliferated the exchange of knowledge and encouraged competition in a free and open market. One of the key differences in the American System was that, like its newly formed government, it was based on democracy. Every individual had the right to invent, manufacture and sell anything he chose, a stark contrast to the “privileges” (Pulos 70) granted to the few in support of the crown (England).

The U.S. Constitution itself also helped to bolster American ingenuity through Article I, section 8: “The Congress shall have power to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive rights to their respective writings and discoveries” (quoted in Pulos 70). This allowed U.S. inventors a protected monopoly or patent in exchange for public disclosure of the idea. The number of U.S. patents exploded from the three issued in 1790 to over 100,000 in 1870 (twice that of the British). The number of patents rose to



“Put power behind patterns, and you have precise identical parts to interchange. Any part can be used in any gin. It’s the same story as Buell’s coins. They fit into any pocket. My coins are metal parts fitting into any gin.”

- Eli Whitney

664,826 by 1900 and by the year 2000 the number was well over 6 million. (U.S. Patent Number Dating Chart). These numbers alone prove the success of the patent office and its impact on U.S. technology.

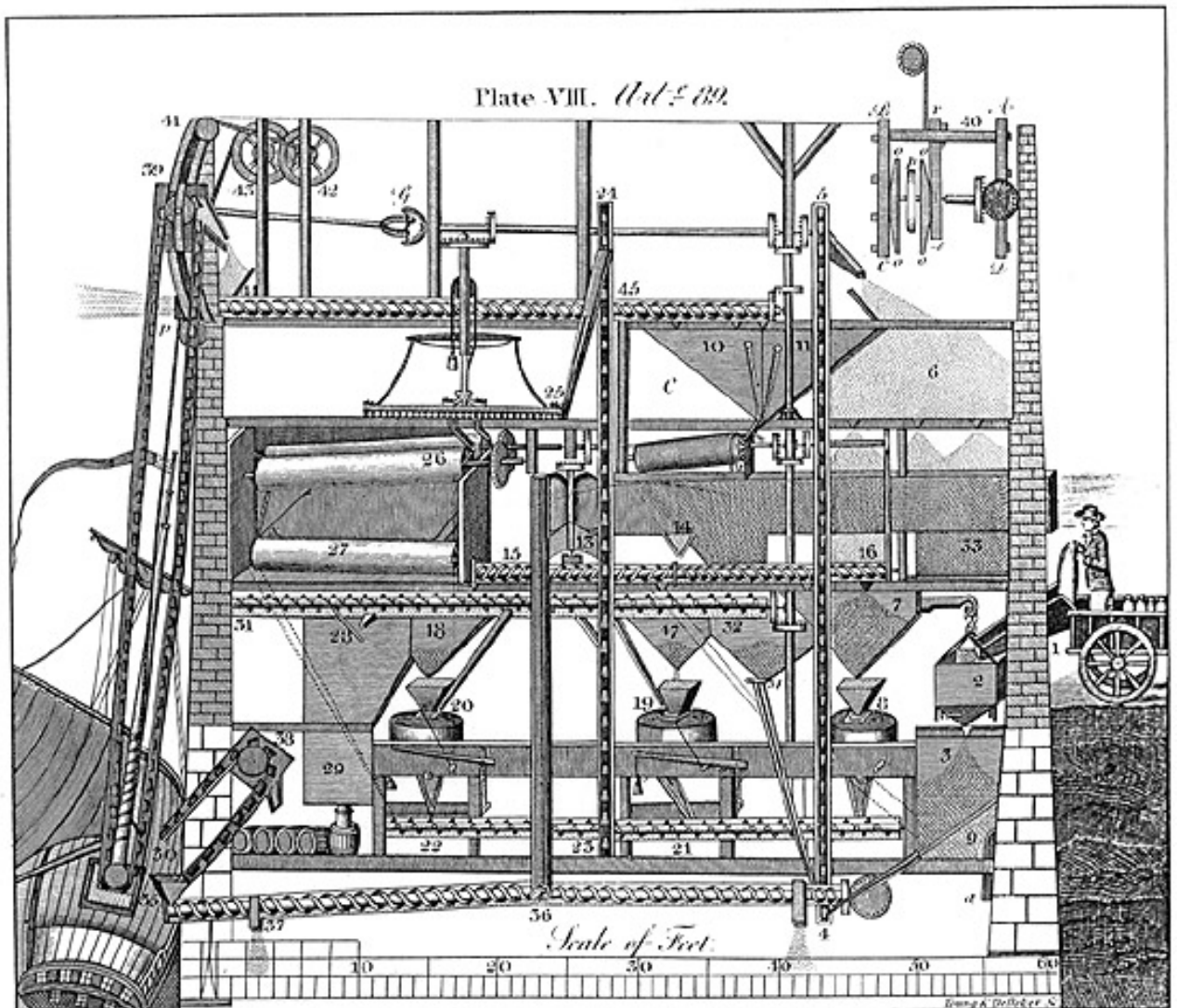
One of the most prolific inventors of the era, Eli Whitney, in strange stroke of fate did not patent one of his most important inventions, the cotton gin, quickly enough. The design was copied by most of his competition and revolutionized the cotton industry in the U.S., increasing cotton production from three lbs a day per person to almost 1000 lbs a day per person. Whitney’s cotton gin, Oliver Evan’s grist mill and Samuel Slater’s textile mill launched the industrial revolution in America. Textile mills sprung up throughout New England and attracted workers from the surrounding rural farmlands. New England dominated the textile industry until the late 1800s when the promise of cheaper labor in the Southern U.S. forced the first major migration of industry. This migration has been repeated several times throughout history and will most likely continue to happen when cheap labor is exhausted.

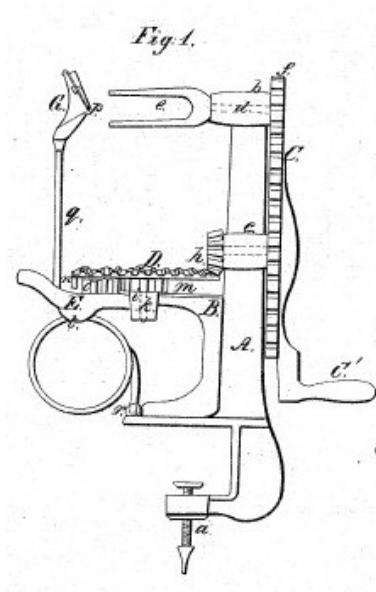
Although Whitney never made any significant financial gains from this design, he didn’t let it stifle his creativity. Whitney went on to become one of the pioneers of standardization and he began supplying the U.S. military with muskets made from interchangeable parts in the early 1800s. Whitney’s American System of Manufacture and its use of interchangeable parts became the blueprint for domestic mass production. Machine made products like the “dollar” pocket watch of the Waltham Watch Company (1850) proved that mass production could offer quality and economy that often surpassed that of expensive, hand made, foreign competition. This manufacturing model was used again and again, thus allowing average Americans access to products historically reserved for only the wealthy.

The Waltham “Dollar” Pocket Watch.



Oliver Evan's Grist Mill was considered his most important invention and is impressive for a man who also invented the first non condensing high pressure stationary steam engine and is credited with being the father of refrigeration.

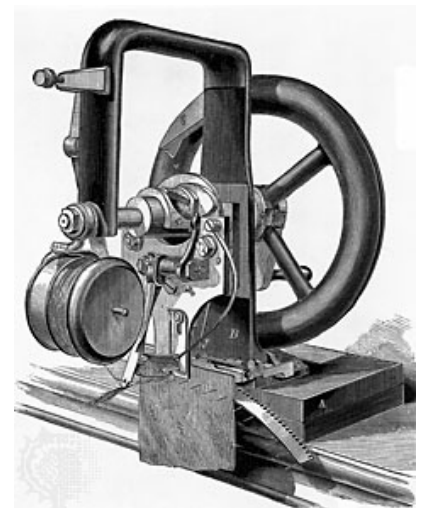




Americans have had a long love affair with improving their daily existence with their own designs. Citizens embraced any labor saving technology, seeing it as the path to equality. Entrepreneurs and inventors hoped to use the free market system as a springboard to wealth. Utilitarian products that attempted to improve the quality of everyday life through mechanizing mundane tasks were the most common. Products such as corn huskers, apple peelers, washing and sewing machines all helped to quell the drudgery of daily living. Distribution and marketing systems evolved as production volumes increased and prices decreased. Advances in transportation and communication systems were developed as a response to industrialization.

The sewing machine was originally invented by Elias Howe (below), but it was Isaac Merritt Singer who brought the product to the masses in the 1850's. The original design used the shipping box as the stand.

Singer was actually sued by Elias Howe for patent infringement for using the Howe needle, but that didn't stop Singer from becoming the leading manufacturer within two years of its introduction.





Even truly American products such as the phonograph and the telephone tended to have a strict utilitarian aesthetic, showcasing the pure functionality of the product.



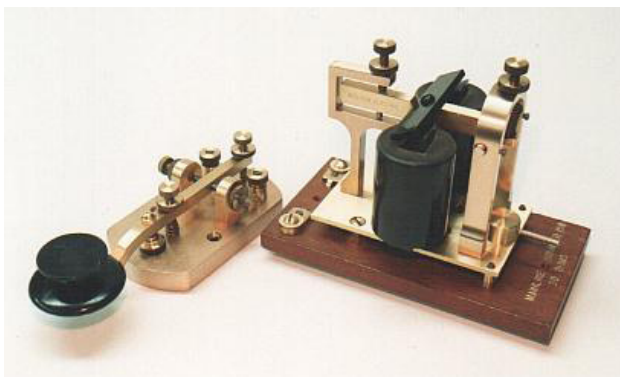
American products opened to mixed reviews at the International Exposition of 1851 in London. At first many of the American wares were chided as “tasteless” (Pulos 110) with “little ornamental value” (Pulos 35), but by the end of the show the *London Times* applauded the ingenuity of products like the revolver and the reaping machine, stating “We may afford to shake hands and exchange congratulations, after which we must learn as much from each other as we can” (quoted in Pulos 116). This exposition provided Europe with a glimpse of America’s mass production capabilities and insight into its consumers. American consumer attitudes focused on lower cost goods with little regard to durability, a strict contrast to the European ideals of the day.

Although American products were making great strides in function and utility, their aesthetics were less than original and were often times styled after existing European products. America, being a country made up of people from around the globe, yearned for products with ethnic ties to the various homelands of its inhabitants. This nostalgia helped manufacturers and merchants reject the need for trained American designers and they continued to copy products in the hopes of increased profits. The amount of piracy inspired legislation on both sides of the world and soon laws were put into effect to reduce the amount of “borrowing” of aesthetics.

The machine and its effects on manual labor had its detractors. Workers were worried that machines would replace them. This caused many European workers to actually dismantle and destroy machines in protest of the threat imposed on their established craft based system. In defense of the anti-machinery attitudes of social philosophers like Thomas Carlyle who feared that machines would infect man’s moral fabric and force him to focus only on materialistic endeavors. American Timothy Walker argued that the nation that developed the most “labor saving machines would make the greatest intellectual progress” (quoted in Pulos 93) because they would have more time to devote to critical thinking. Walker’s attitudes sum up the American work ethic and drive for a better way of life for its citizens that eventually propelled the U.S. to become the model for industrialization, and ignited an era of unparalleled invention. This marked the final transition of craft to manufacturing.

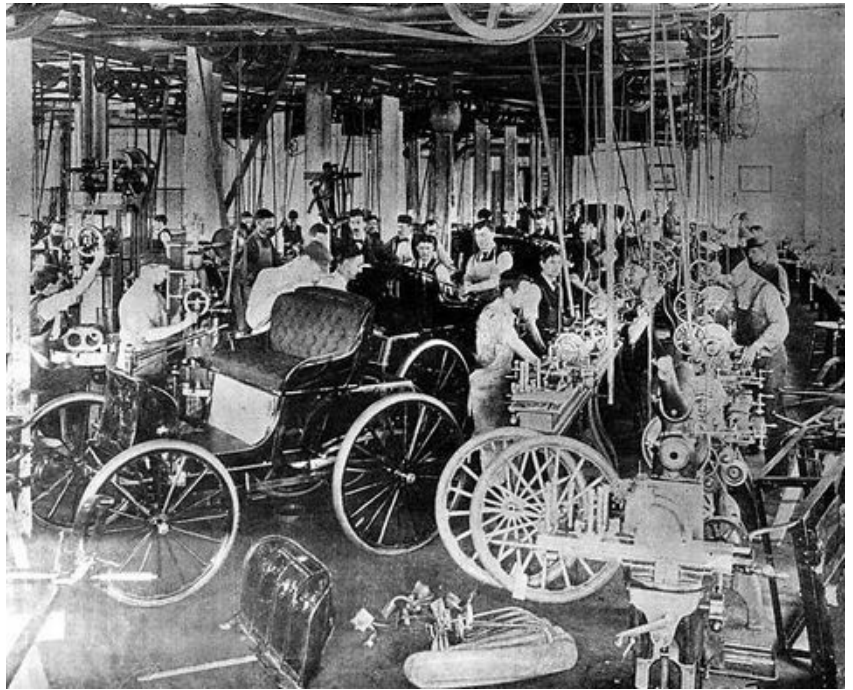
Mr. Watson, come here; I want you.

The telegraph invented in 1844 was the most important communication device until the telephone emerged in 1876. Alexander Graham Bell’s work with the telegraph and fascination with sound led him to the telephone.





The 1893 Duryea was the first gas-powered automobile manufactured in the United States. The Duryea factory photo illustrates auto manufacturing prior to the assembly line.



“Technological centralization was replacing the vertical structure of craft technology (in which the artisan participated in every stage of his product’s evolution) with a horizontal stratification (in which one layer of employees is charged with planning a product, another with its manufacture, and a third with its merchandising). It was at this point that the emergence of the industrial designer as the catalyst between these three layers and the consumer became inevitable.” – (Pulos 83).



Henry Ford's Quadricycle was first sold in 1896 for \$200.



Completion of the trans-continental railroad in 1869 marked a new era in transporting goods and people across the United States.



Rural Free Delivery made mail order delivery of goods possible, giving birth to catalog retailers like Sears & Roebuck in 1886.

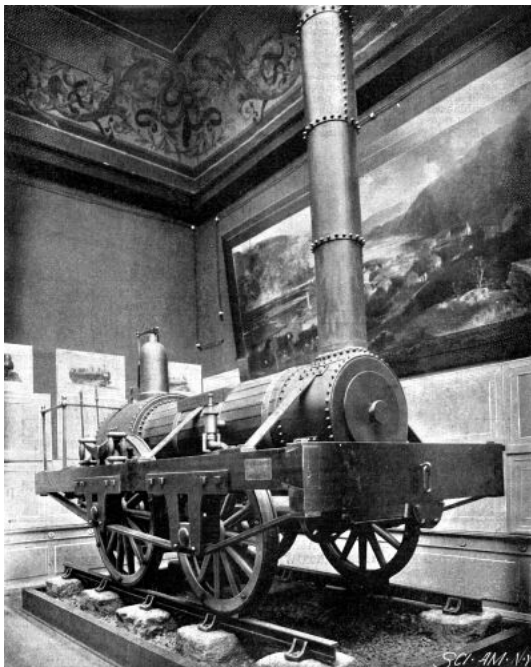
Industrialization and western expansion began to make the U.S. and the world seem smaller. Increased production, fueled by lower costs and consumer demand forced innovation in transportation and communication. The trans-continental railroad connected the east and west U.S. in 1869, which expanded markets and allowed products to be shipped farther from their place of origin. The expansion of the post office to include free city mail delivery and later the free rural delivery helped to promote better roads. The advances in communication and infrastructure created new ways of retailing such as catalog and multi-store chain retailers. Woolworth's 5 & 10 stores revolutionized retailing, being the first to allow the shopper to browse the merchandise before buying. The first store opened in Utica, NY in 1878 only to close within the year. The first successful Woolworth's opened in Lancaster, PA in 1879. Sears & Roebuck launched its first mail order catalog in 1886, which helped isolated settlers buy the products needed to tame the wilds of the frontier. Everything from blue jeans to homes could be bought in the catalog. This gave rise to even more independence and individuality of American consumers.

Woolworth's 5 & 10 store in Watertown, NY.





The clipper ship, steam locomotive and steam ship pushed the nation even further westward. Canals, roadways and railroads expanded the reach of manufactured goods.



Improvements to reliability and infrastructure pushed the nation westward. Faster, more powerful locomotives, clipper ships and steam ships were needed to move goods and people from one location to another quickly and efficiently. The clipper ship, an American innovation, was the first ship to not base its hull design on the shape of a fish. The bow of the ship was shaped more like the edge of a knife to cut through the water. A clipper ship could sail up to 400 miles a day and became the quickest method of travel from New York to San Francisco.

The telegraph revolutionized communication in 1844 and was followed up by the telephone 33 years later and the radio in 1895.

Turn of the Century

The demand for new products in America at the turn of the 20th century was so great that labor needed to be imported to fill the factories. This time of unparalleled industrialization lured millions of immigrants mostly from southern and eastern Europe to seek a better life in America. Home to the highest paid manufacturing jobs in the world, America offered access to a system where opportunity was available to all. The populations of cities exploded with salaried workers, armed with ample disposable income, in close proximity to the stores that sold the very products that they helped produce. This created a materialistic spirit unique to America, where the boundaries of want and need are blurred in the pursuit of the “American Dream.”

Life changed significantly in the “new century” (Pulos 227) with the widespread acceptance of the automobile and the use of electricity. Entirely new products using electricity began to revolutionize domestic life. Electric flatirons, teapots and griddles promised to make life easier. All of these labor saving devices created a new phenomenon in middle class life: the idea of leisure time. Daily life began to evolve from sheer survival to the notion of recreational activities and the products associated with them. These inventions, and the demand for the resulting products, could no longer be met by the localized industrial system, where groups of industries supported one another in close regional areas. This led to a system made up of large, specific manufacturing hubs, such as Pittsburgh for steel, Detroit for autos and Toledo for glass. These hubs with improving communication and transportation began to support the nation and the world as a whole. Syracuse, N.Y. is great example of the industrial towns and cities that dotted the landscape at the turn of the century, before the growth of the manufacturing hubs. (see next section)

This was also a time of social change and the progressive movement (1900-1914) supported by the middle class, promoted a “more humane and creative society” (Votolato 9). The movement hoped to calm labor unrest and improve working conditions while supporting better health care, consumer rights and women’s suffrage. The movement was validated by the ascension of Theodore Roosevelt to the U.S. presidency after McKinley was assassinated in 1901, ironically enough at an exposition to showcase America’s manufacturing might, the Pan-American Exhibition in Buffalo, N.Y.

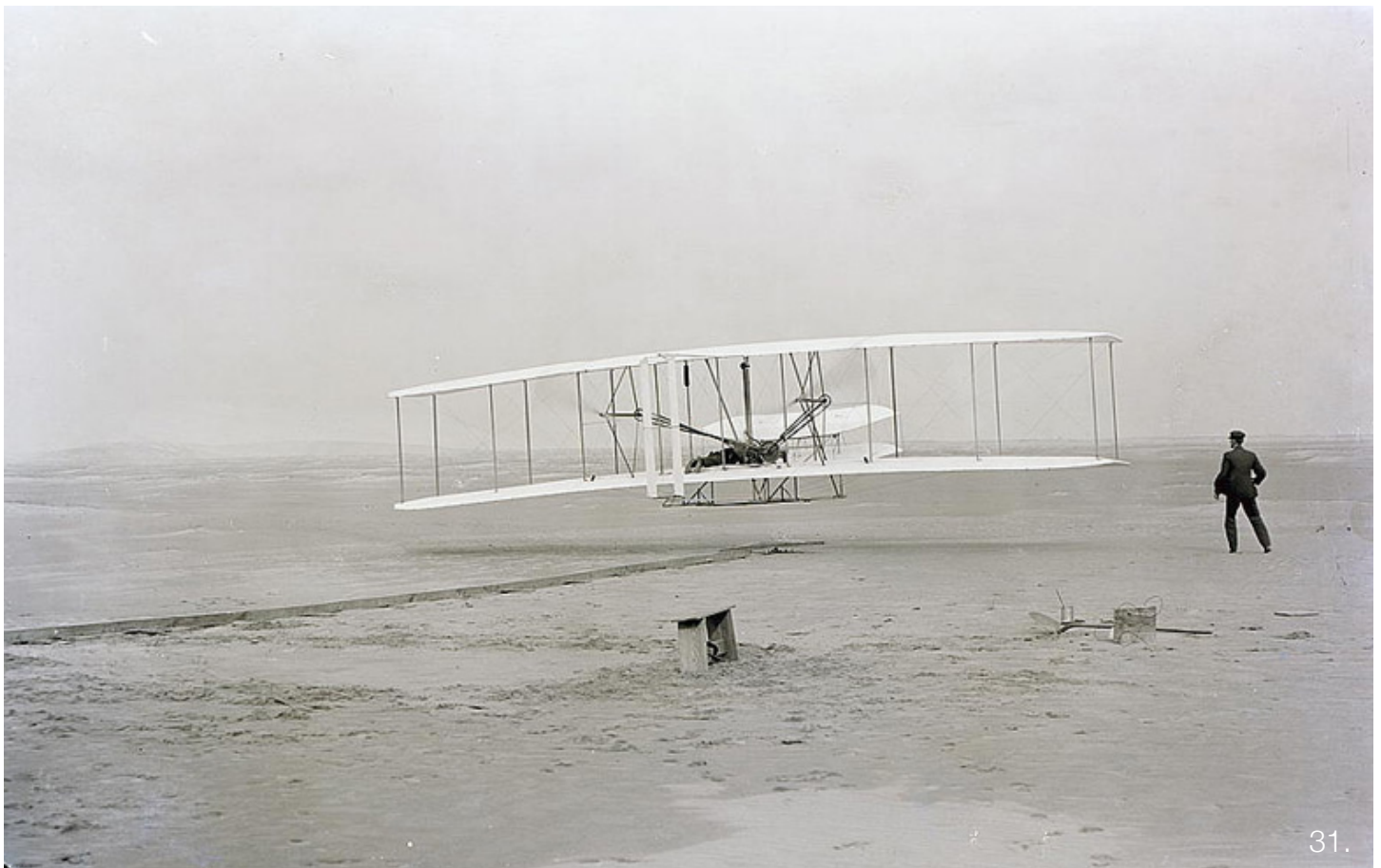


1903 Harley Davidson Motorcycle.
Harley would become one the most
30. heavily customized products ever.

Prior to their work on the airplane, the Wright brothers manufactured bicycles. The one to the right is the St. Claire model, one of only five known to exist.



December 17, 1903 would forever change transportation history when the Wright brothers took flight at Kitty Hawk.



FOUR POPULAR CRAFTSMAN HOUSES



NO. 132: SEVEN-ROOM CRAFTSMAN CEMENT BUNGALOW

THE one-story bungalow illustrated here (No. 132) was planned for a small family where one maid is to be kept. As the arrangement is comparatively simple, however, and there are no stairs to climb, the mistress could keep the place in order without much trouble.

The building is 55 feet wide and 58 feet 8 inches deep—these being the outside measurements, including the front porch.

This bungalow has been especially planned for a site with plenty of space around it. Although it could be built on level ground, it would look much better placed higher than the roadway, as we have shown it, on a terrace or low rolling hillside. If it were to be erected near other houses, however, it should have as high a placing as possible,

for if it were built on low ground it would be apt to seem oppressed by the surrounding buildings. This house is admirable for a seaside position because of its low lines.



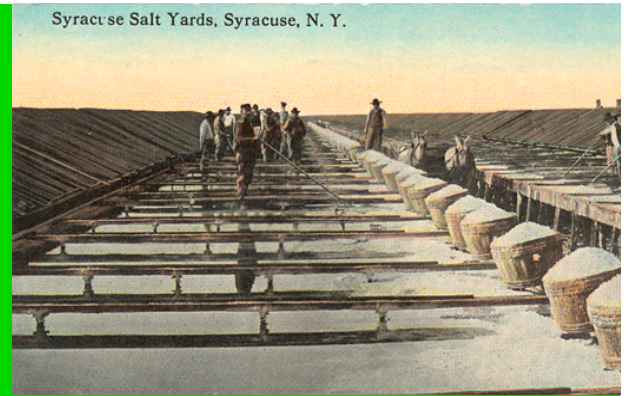
431



Stickley created a craft inspired product which was cleverly marketed to the masses through "The Craftsman" magazine. The simple clean lines and proportion are timeless.

The aesthetic counterpart to the progressive movement was the American Arts & Crafts movement. Initially based on the ideas of William Morris, the American interpretation was significantly different from the European notion. Although both looked to incorporate the master craftsman taking pride in his work, the European model was more of a response to man becoming a slave to the industrial complex and catered to the upper classes. Its main premise was to eliminate the division of labor where the master would touch all aspects of a product's construction while restricting machine use to only the most mundane and repetitious of tasks. The movement in America took on a more bourgeois tone, with businesses seeing an opportunity to supply the middle class with furnishings and artifacts made of honest forms and material. The products created by the likes of Gustav and Leopold Stickley were seen as classless, truly democratic products that filled the void between the hardworking middle class and the imported decorative furnishing favored by America's Nouveau Riche.

The Stickley's interpretation of Arts & Crafts allowed them to promote the ideals of the movement while using the division of labor, standardization, and machinery as a necessary means to commercial viability. The publication of Stickley's own magazine *The Craftsman* along with its New York City showroom helped popularize its own products while encouraging "the virtues of democratic life" (Votolato 96). Stickley has become synonymous with the craftsman style and his writings and products continue to influence other products, furniture and architecture to this day.



Syracuse: A Typical American Industrial City

“Syracuse at the turn of the century was bursting with invention and industry, a period of such rapid growth that it is almost difficult to imagine today.”

- Tim Knauss (Knauss 01)

Syracuse is a great example of the industrial towns and cities that dotted the landscape at the turn of the century, especially in the northeast. Historically known for its high quality salt (produced by boiling down salty water from the natural springs around the shores of Onondaga Lake), Syracuse transitioned from a cottage industry based economy dependent on the abundant natural resources of the region into an industrial powerhouse fueled by innovation. The city was home to a variety of industries and out produced even New York City at the time. Shotguns, typewriters, cigars, electrical products, automobiles, chemicals, shoes, canned meat, glass, ceramics, paper were just some of the many products made in Syracuse. The Erie Canal coupled with an integral rail system helped connect these industries not only with each other but with much of the country as well. Manufacturers such as Solvay Process, who produced soda ash, supplied the necessary materials to produce products such as glass and soap. The sheer amount of manufactured goods was staggering.

L.C. Smith Shotguns are some of the most sought after in the world. This is the “Baker 3 barrel” which came as a 10 or 12 gauge side by side with a third .44 caliber rifle centered between. It was manufactured in Syracuse from 1880-1888. Notice the Damascus steel barrel, a true rarity in American guns. Smith also founded the Smith Premier Typewriter Company which eventually became Smith-Corona. The Syracuse University Industrial & Interaction Design program currently resides in L.C. Smith Hall.





Syracuse China was and is known for durable, high quality stoneware popular in restaurants everywhere.



The traffic light was invented and manufactured by Crouse-Hinds in Syracuse.

In 1910, the Syracuse Chamber of Commerce ranked local industries in this order:

1. Iron, steel and related products accounted for 75 factories and 10,759 employees. Examples included Halcomb Steel Co., where 800 workers made 12,000 tons a year; Globe Malleable Iron & Steel Co., which had 300 employees; and Archbold-Brady Co., which had 125 employees and turned out 3,000 tons of structural steel a year for building construction.

2. Textiles, including clothing: 29 factories and 4,770 employees.

W.S. Peck & Co. had 862 employees and turned out 400 suits a day. A.E. Nettleton Co. was the world's biggest manufacturer of men's shoes.

3. Chemicals and related products: 25 factories and 4,282 employees. Examples included General Chemical and Solvay Process.

4. Vehicles and land transportation: 10 factories and 2,225 employees.

The Franklin Automobile Company was the third largest U.S. automotive manufacturer at the time.

5. Metal products other than iron and steel: 22 factories, 1,439 employees.

6. Leather and related products: nine factories, 1,159 employees.

7. Cut glass and stone products: 22 factories, 1,119 employees.

8. Lumber and related products: 28 factories, 974 employees.

9. Food products: 26 factories, 945 employees.

10. Tobacco: 10 factories, 511 employees.

11. Paper and printing: 11 factories, 510 employees.

12. Liquor and beverages: 10 factories and 448 employees

(Knaus)

1918 Franklin



Syracuse produced a multitude of products in the early 20th century but none was more innovative than the Franklin automobile. The Franklin Automobile was manufactured in Syracuse from 1902 until 1934. It was the first air cooled, aluminum bodied car made in America. Billed as the “car that couldn’t overheat” it was very popular in desert communities like Palm Springs, California. It set two major coast to coast speed records due to its powerful engine and lightweight body. Considered ahead of its time with features like automatic timing advance and die-cast aluminum parts, its unconventional front end without the need for a radiator may have led to the company’s demise.

Known for its exposed valves, they needed to be oiled “everyday, at noon” according to the manual.



San Francisco
to
New York
in a

FRANKLIN

Last August, in its famous "Ocean to Ocean" run, the *Franklin* cut the record nearly in halves.

It crossed the blazing sands of the great American desert—the hottest part of the United States in the hottest month—eating up the miles steadily through the broiling, sizzling days, without stop, break, or hitch, and kept on getting ahead of the record every day.

How's that for air-cooling?

Every test which the *Franklin* has undergone shows that its fascinating and lively flexibility is not a mere showy, temporary matter—a spurt: but it is a solid permanent virtue which can be counted on every time.

In the St. Louis Tour the *Franklin* did 178 miles in 8 hours without stopping the motor; and all through the summer races showed heels to cars of twice its weight and thrice its power.

At every point—speed, touring and endurance—the *Franklin* has settled the air-cooling question forever.

Keep your eyes on the *Franklin*. It isn't a great big lot of machinery and plumbing, but it does go!

Light Car Light Tonneau 24 H.P. Touring Car

Send for catalogue which tells all the facts.

H. H. FRANKLIN MFG. CO., 305 Geddes St., Syracuse, N.Y.
Member Association Licensed Automobile Manufacturers.

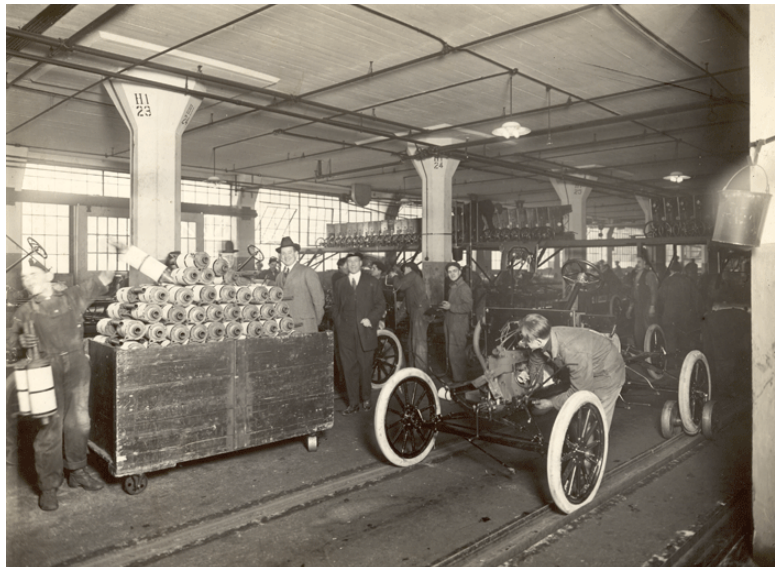
'GOLD RUSH' IS STARTED BY FORD'S \$5 OFFER

Thousands of Men Seek Employment in Detroit Factory.

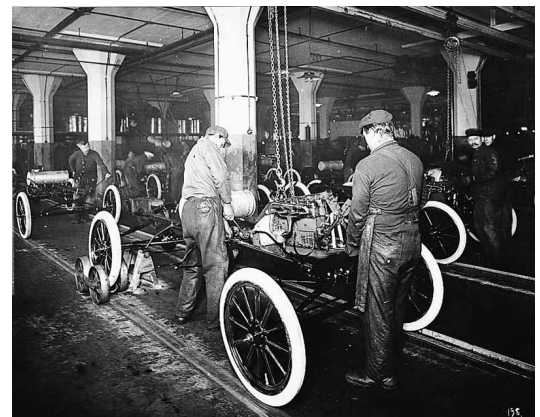
Will Distribute \$10,000,000 in Semi-Monthly Bonuses.

No Employee to Receive Less Than Five Dollars a Day.

(TIMES-STAR SPECIAL DISPATCH.)
DETROIT, Mich., January 7.—
Henry Ford in an interview to-



Ford's assembly line marked a major breakthrough in American manufacturing.



It was soon realized in the early part of the century that to sustain continued growth manufacturers needed to develop ways to make more products more efficiently. Ford's development of the assembly line in 1914 helped to drop the price of the Model T from around \$850 to \$350, which in essence democratized the product and made it affordable to the middle class workers that built it. Ford also recognized that by paying his workers more for a shorter workday, \$5 for an eight hour work day opposed to the customary nine hours, it would make owning a vehicle easier while granting more time to use it. It should also be noted that this made three, eight hour shifts within a 24 hour period possible and soon became the model for many other manufacturers. Later, Ford would build the largest integrated factory in the world at the River Rouge plant, which included docks, railheads, a steel mill and a glass factory.

Ford's River Rouge Plant, early 1900's



Most American products in the early 1900's were based on European designs. Many new to the world products lacked any visual history to draw upon. Products such as electric fans and vacuum cleaners often had superficial details with little reference to the product's particular functionality. This prompted organizations like the Decorative Art Society to pressure the National Board of Education to form a committee to develop a stronger design education program for the benefit of companies and the economy alike. This attempt didn't succeed in the immediate implementation of a comprehensive design education system as most manufacturers were still rooted in a vernacular design aesthetic supported by foreign artist/designers. This didn't really change until after the First World War, which disrupted the flow of European design talent to American industry. Following the war Germany mandated that no technical workers would be allowed to leave the country in fear of losing its creative identity. It also established the Bauhaus School in Weimar in 1919, which would become one of the most celebrated art & design schools in history.

Since most of Europe understood the value of industrial arts education, Europe did not let the war interfere too much with design training. This allowed Europe to assume its design leadership role after the armistice was signed in 1918. U.S. manufacturing, with its reliance on its "borrowed" European design aesthetic was still slow to recognize a need for native design talent. This was a hotly debated topic at the time and with the help of the government's support of the Charles Richards Study on the state of industrial arts education in the U.S., the wheels were in motion to develop a better education system. One of the chief concerns for attracting talented artists to the industrial arts field was the sheer anonymity of the designer in the process. In Europe, artist/designers were celebrated but in the U.S. designers were often viewed as invisible cogs in the industrial machine. Many early artists that were commissioned for industrial endeavors preferred to remain anonymous in fear that they would be viewed as "sell outs" to their peers. The carry over of anonymity is still common in American design today, with very few industrial designers being highly visible outside the companies where they work. Design in America is still viewed by many as a democratic process with little need for personal recognition.

Walter Gropius founded the Bauhaus School in 1919.



WWI: War with Technology



The quintessential automatic handgun typform developed by John Browning in 1905

The Great War was a different kind of war, a mechanized war that introduced weapons never seen in history. Tanks, machine guns, zeppelins and airplanes depersonalized the act of killing by becoming a buffer to the horrors of war. This marked a turning point in time when technology began to dehumanize everyday life and restrict interaction amongst people. The telephone replaced face to face communication and the automobile isolated us from each other on the ride to work. The use of the machine and its interfaces as intermediaries between humans continues to evolve today.

Word War I was a boost to the American economy, with agriculture and industrial production capitalizing on Europe's reduced manufacturing capacity. The use of Henry Ford's assembly line methods for war production showcased American industrial might to the world. The country had gained a new sense of patriotic pride based on its contribution to the war effort and the proliferation of democracy.

WWI marked the first time innovations like the airplane were used in combat.



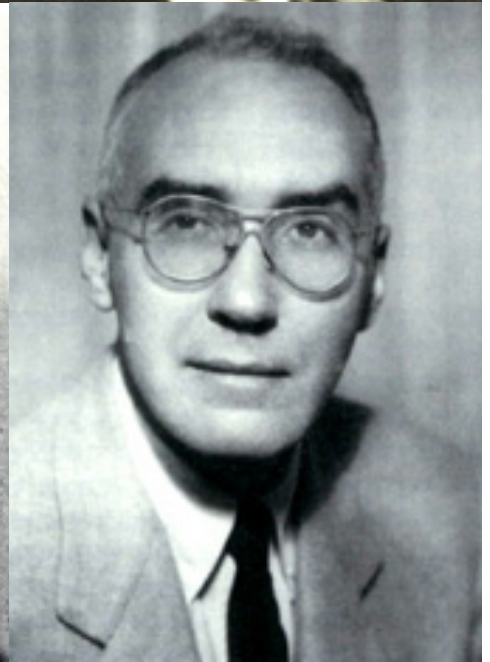
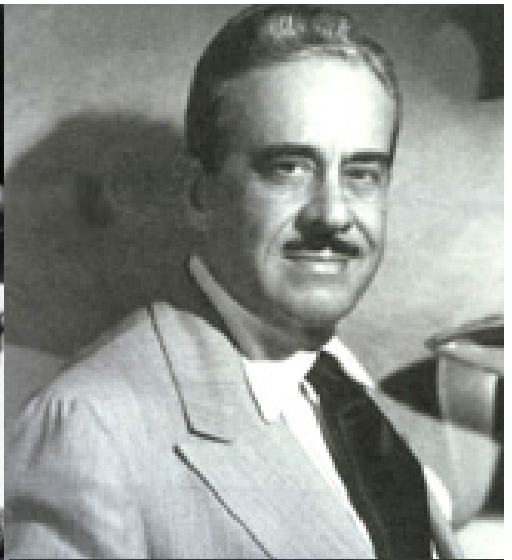
Post World War I: Rise of Design Education in America

After the war, the French hosted the International Exposition of Decorative Arts, one of the most influential exhibitions in early industrial design history that in effect ended the decorative arts movement and introduced Art Moderne (considered the movement that invented industrial design). Unfortunately, no Americans presented their work, as there was no original work considered worthy of display. The U.S. and China were the only two countries to be invited but not present anything. This embarrassment became a wake up call to America and the U.S. press was the first to openly criticize industry for not recognizing the value of design. The Metropolitan Museum of Art began to stage exhibits in the modern style as a response to the success of the Paris show. American retailers quickly followed suit and demanded new products and furnishings in the Moderne style, even staging exhibits of their own. In 1928 Macy's department store staged an "International Exposition of Art in Industry." Its success proved that there was a demand for stylish, more aesthetically pleasing products.

The Paris exposition also provided further evidence that design education in America needed to exist. The lack of formal industrial arts training in the U.S. shapes the American ID profession, heading it in a very different direction from the European model. It is purely coincidence that design and business education grew in parallel with one another during the 1920s but the strong connection between the two continues today. This marriage was and is one of the key differences between American and European design philosophies. Traditionally, American design has always been more concerned with commercial appeal (selling more products) and utility rather than aesthetics, whereas most European design tends to be centered on decorative arts and furnishings.

As result of the poor state of industrial arts education, many early American designers had to be drawn from other related commercial art fields such as advertising. Advertising brought two important principles to the design world, an understanding of business and the knowledge of high-speed production methods. It was only a matter of time before they would begin to offer design services in an effort to better serve clients. As competition grew and products began to become technically similar, mass production and higher volumes became increasingly more important for manufacturers to make a profit. Manufacturers soon turned to advertising agencies to help push their wares on the public in an effort to keep their volumes and profits up. These agencies realized early on that there was value in design and products that were visually more appealing tended to sell better. It made perfect sense that many of the original product design commissions came at the urging of the ad world.

It should be noted that several of the most influential American industrial designers profiled in the February, 1934 issue of *Fortune* had advertising backgrounds including Lurelle Guild, Donald Deskey, Walter Dorwin Teague, Norman Bel Geddes and Henry Dreyfus. The Calkins and Holden firm is considered the first advertising agency to offer product design as one of its services. Walter Dorwin Teague worked at the Calkins-Holden agency early in his career and credits its founder, Earnest Elmo Calkins, with teaching him how to make a "successful business of art" (Pulos 283). Other prominent design pioneers worked at Calkins-Holden, including Egmont Arens, Norman Bel Geddes and Joseph Sinel.



Walter Dorwin Teague, Henry Dreyfus, Raymond Lowey,
Donald Deskey, Lurelle Guild, Norman Bel Geddes,
John Vassos, Egmont Arens, Russel Wright



A collection of design work from the pioneers of Industrial Design.

The Golden Age of Industrial Design

The 1920's and 30's marked a serious boost to industrial design in America with a wave of influential designer immigration, which began with the likes of Raymond Lowey from France, John Vassos from Greece, Gustav Jensen from Denmark, and Peter Muller-Munk from Germany. The wave culminated with László Moholy-Nagy and the reopening of the Bauhaus in Chicago in 1937. Lowey would become one of the most celebrated industrial designers in history and was pivotal in early transportation, product and packaging design. He was also the first to grace the cover of *Time* magazine and along with Henry Dreyfus would be considered one of the first to accept an industrial design commission in 1929.

The 1930's, even in midst's of the depression, became the golden age for industrial design. It was a time when consumers would only pay for new and innovative products. Manufacturers, in an effort to keep sales up, used industrial design as means to fulfill the demands of the public. It was a time when just about every manufactured object needed design input. Modern styling was used as a visual indication that gave hope to the masses that better things were on the horizon.

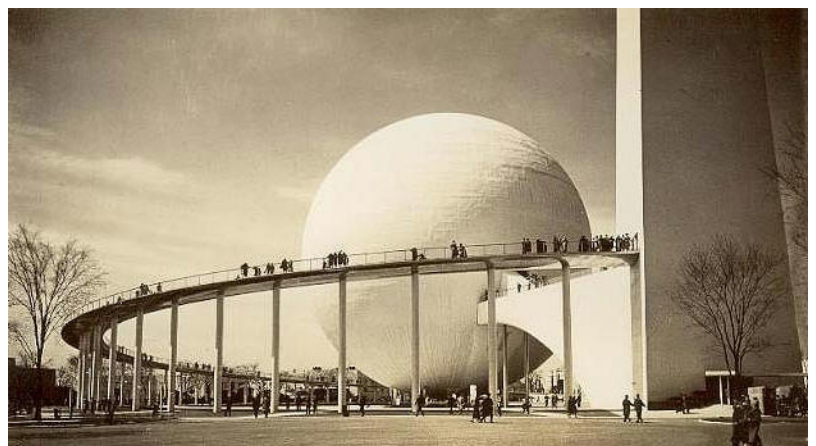
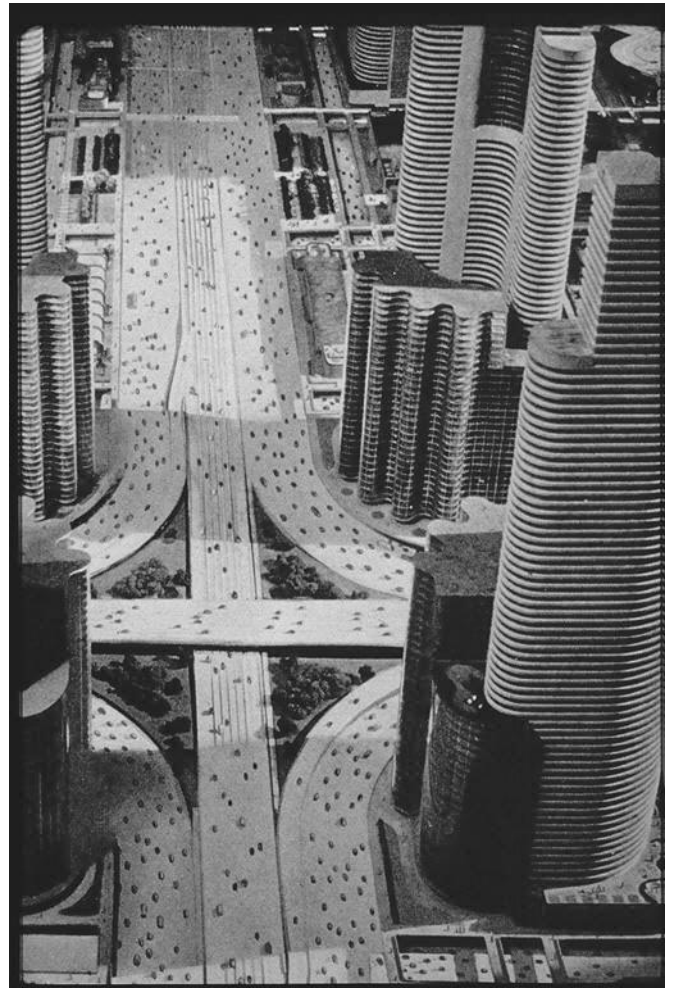
The 1939 Worlds Fair in New York City was the perfect ending for American design's biggest decade. Many of the aforementioned pioneers participated in the event in some way. This would become American Design's coming out party, proving to the world that technology, mass production and industrial design would help shape its future.

Planning for the fair began in 1935 when over a hundred designers (including Walter Dorwin Teague and Gilbert Rohde), architects, and civic engineers got together with businessmen, sociologists and educators to discuss ideas that the fair would represent. "Building the World of Tomorrow," became the official theme and industrial design helped set the stage with the ideal vision of the future of civilization. Lowey's transportation exhibit showcased a trans-Atlantic "Rocketport", which would offer non-stop flights to and from London. Dreyfus took on "Democracity," a futuristic vision of cities where business and home life were separated by a commute using high-speed parkways. One of the fair's most popular destinations was Norman Bel Geddes "Futurama" designed for General Motors, which whisked up to 30,000 visitors per day in moving chairs along intercontinental super highways. "Food," by Russel Wright, discussed nutrition, the optimal diet and how food problems of the future (famine, drought) could be solved. "Production & Distribution" by Egmont Arens argued that distribution needed to be as efficient as mass production to satisfy the wants and desires of the consumer. The idea of consumer engineering or "humaneering" (Meikle 71) was to eliminate "the obstacles in the way of the free flow of goods from factories to consumers" (Meikle 71).

It should be noted that many of the futuristic ideas of the Fair have become a reality today. Super highways connect all of the cities in America, the suburban life predicted by Dreyfus is the norm and up until recently the Concorde transported passengers across the Atlantic at supersonic speeds. Nutrition is a very important part of today's increasingly healthy lifestyle and advances in technology are streamlining the distribution of goods to the consumer.



The 1939 World's Fair showcased the future predictions of many prominent industrial designers of the time.



"Futurama" and "Democracy" were the most popular exhibits at the 1939 World's Fair. The concepts presented as the future would soon be realized.

WWII: War of Production

World War II was the apex of American manufacturing might. The ability to mobilize industries from civilian to military production in a matter of months was unprecedented. The rapid growth caused by the war effort was a boom and a bust. Several manufacturers used the wartime experience as a springboard to success, others had difficulty transitioning back to a civilian economy.

American manufacturing was already hitting its stride in 1940 thanks to a pre-war housing boom that increased demand for home furnishings, appliances and automobiles. The rest of the world was at war and the looming possibility of American involvement meant that there could be a shortage of consumer goods if manufacturing switched over to war production. The anxiety was well founded, as the federal government began to distribute lucrative defense contracts in 1940, manufacturing shifted to war materials.

Over 16 million Americans served in the armed forces during the war. Those who stayed behind supported the war effort any way they could from buying war bonds to collecting metal to working in the factories that produced the machines and weapons used by the troops. Women joined the workforce in numbers never seen before, working in manufacturing areas usually reserved for men, jobs such as welding or riveting were not uncommon. Most consumer products were not available during the war, and even sugar and gasoline were heavily rationed. President Roosevelt banned automobile production during the war and no domestic cars were manufactured from early 1942 until 1946, instead they used around the clock shifts to produce everything from tanks to jeeps to airplanes. Manufacturing boom towns appeared almost overnight as up to 20 million people flocked to the high paying jobs created by the war effort.

The U.S. led all other countries in manufacturing during the war and its contribution to the war effort clearly had the biggest impact on the outcome. The war is what made the U.S. into a manufacturing superpower and the model for the rest of the world. America's sheer geographic size coupled with its abundant natural resources and its intact industrial base are just some of the reasons for its manufacturing dominance during the war.

Table 1.7. War production of the great powers, 1942–1944

	Rifles, carbines (thou.)	Machine pistols (thou.)	Machine guns (thou.)	Guns (thou.)	Mortars (thou.)	Tanks (thou.)	Combat aircraft (thou.)	Major naval vessels
<i>The Allied powers</i>								
USA	10,714	1,685	2,291	512	61.6	86.0	153.1	6,755
UK	2,052	3,682	610	317	65.3	20.7	61.6	651
USSR	9,935	5,501	1,254	380	306.5	77.5	84.8	55
Allied total	22,701	10,868	4,154	1,208	433.4	184.2	299.5	7,461
<i>The Axis powers</i>								
Germany	6,501	695	889	262	66.0	35.2	65.0	703
Italy	—	—	83	7	11.3	2.0	8.9	218
Japan	1,959	3	341	126	4.3	2.4	40.7	438
Axis total	8,460	698	1,313	395	81.6	39.6	114.6	1,359
Allies/Axis	2.7	15.6	3.2	3.1	5.3	4.7	2.6	5.5
eastern front	2.3	11.9	2.1	2.2	7.0	3.3	2.0	—
western and Pacific fronts	3.1	22.9	4.0	3.8	3.4	6.6	3.0	—



The War Production Board commissioned posters such as these to stress the importance of manufacturing to the public.



Even before the U.S. entered the war its production, illustrated here in gross domestic product (GDP) far outweighed every other country.

Table 1.3. Wartime GDP of the great powers, 1939–1945, in international dollars and 1990 prices (billions)

	1938	1939	1940	1941	1942	1943	1944	1945
<i>Allied powers</i>								
USA	800	869	943	1,094	1,235	1,399	1,499	1,474
UK	284	287	316	344	353	361	346	331
France	186	199	82	—	—	—	—	101
Italy	—	—	—	—	—	—	117	92
USSR	359	366	417	359	318	464	495	396
Allied total	1,629	1,721	1,757	1,798	1,906	2,223	2,458	2,394
<i>Axis powers</i>								
Germany	351	384	387	412	417	426	437	310
France	—	—	82	130	116	110	93	—
Austria	24	27	27	29	27	28	29	12
Italy	141	151	147	144	145	137	—	—
Japan	169	184	192	196	197	194	189	144
Axis total	686	747	835	911	903	895	748	466
Allies/Axis	2.4	2.3	2.1	2.0	2.1	2.5	3.3	5.1
USSR/Germany	1.0	1.0	1.1	0.9	0.8	1.1	1.1	1.3



The Boeing B-17 Flying Fortress Bomber was considered the first mass produced large scale aircraft. It dropped over 500,000 tons of bombs during the war.



Jeeps were actually built by three different car manufacturers, Bantam originated the design but because the small Butler Pennsylvania company could not keep up with demand, Willys and Ford also manufactured them.

Women entered the industrial workforce in unprecedented numbers during the war due to a shortage of able bodied men. Dual income families attributed to a 60 percent increase in non-farm incomes between 1939 and 1943. Some argue that this was the birth of middle class erosion in the U.S. as families worked their way into another class level.



Turret lathe operator machining parts for transport planes at the Consolidated Aircraft Corporation plant, Fort Worth, Texas, USA



Post War Boom: Rebuilding the World

Except for the U.S., the manufacturing infrastructure of every other industrialized nation in the world was decimated by the war. The fact that not one of our factories was leveled during the war, put America in the driver's seat in terms of world manufacturing power following the war. America and the world needed new products and the U.S. was happy to oblige. Americans had sacrificed many of the products that they had grown accustomed to prior to the war and the demand for new products was staggering. The returning G.I.'s, with little to spend their money on during the war itself had a great deal of disposable income, and with the help of government assisted loan programs, almost immediately began buying new homes, furnishings and autos. Many returned to spouses who also worked during the war, creating two income families with huge buying power. The housing and baby boom following the war created an even greater demand for production as the population increased.

The government enacted the Marshall plan in 1947 to help European nations recover from the ravages of war. Most European countries lost much of their industry and transportation infrastructure during the war. They also had depleted much of their financial means fighting the war. The Marshall plan provided assistance until 1951 and put Western Europe on the road to recovery while helping eliminate the proliferation of communism on the continent. It also secured open markets for U.S. goods and helped to extend America's post war boom.

Levittown New York was considered one of the first planned suburban communities in the country. Built as an answer to the post war housing shortage, Levittown provided affordable single family residences for around \$8000. These simple Cape Code style homes began the suburban movement and in a way fulfilled the 1939 Word's Fair Prophecies of Dreyfus and Bel Geddes.



Registration day showing increased enrollment at Harvard following the enactment of the GI Bill.



The production of war materials did not end after the war as most assumed. The military-industrial complex (coined by President Eisenhower) continued to play an integral part in winning the cold war with the Soviet Union. The government sanctioning of military production helped to maintain the manufacturing momentum started by the war. Several advances in technology and materials were a direct result of this. Nuclear power, jet power, the transistor, the laser and advanced plastics were all derived from the military-industrial complex.

The GI bill or Servicemen's Readjustment act of 1944 provided federally funded educational assistance, up to one of year of unemployment compensation and low interest loans for housing and businesses. This act caused an enormous jump in college enrollment with schools such as Syracuse University leading the way. Enrollment at Syracuse went from 6000 students before the war to almost 19,000 by 1947. This increase in post secondary education had far reaching impact on the development of a white collar workforce, who by the end of the 1950's outnumbered their blue collar counterparts.

"For European Recovery Supplied by the United States of America" a load of wheat being delivered to the Netherlands under the Marshall Plan



The Decline of Manufacturing in the U.S.

The mobility of Americans increased significantly with the availability of dependable yet affordable automobiles, which made suburban life possible. Subdivisions such as the Levittowns in New York and Pennsylvania sprung up almost overnight in the late 40's and 50's. Low cost, single family housing could be had with a \$90 down payment and \$59 per month. Air conditioning made life possible in many of the "sun belt" cities throughout the south and southwest.

International trade was fostered by the advent of establishments such as the International Monetary Fund (IMF), which helps facilitate international monetary cooperation and exchange stability. The organization that was started in 1945, now has 185 members and has helped promote international capitalism. The World Bank is "a vital source of financial and technical assistance to developing countries around the world" (WorldBank.org). The overriding goal of the World Bank is to reduce world poverty and improve the living conditions of everyone. The formation of these institutions set the stage for a global economy, opening trade channels that never existed before.

In 1955 a new program initiated by the International Cooperation Administration (ICA) was administered to support industry in developing nations. This was an attempt to stave off communist inclinations of unstable governments by building independent economies. The ICA contracted several prominent industrial designers and their respective firms to survey craft based technologies in several developing regions. The designers would then recommend actions that would enhance the quantity, quality and dependability of the native products while making them more competitive in the open market. The designers were also tasked with adjusting the products appearance and characteristics to appeal to American tastes. Basically these designers went out to teach the rest of the world how to design and manufacture products based on the American model. Russel Wright visited Southeast Asia, Walter Dorwin Teague went to the Middle East, Design Research Inc went to Central America plus Pakistan and Afghanistan, while others visited nations such as India and South Korea. Although these designers were asked to not interfere with indigenous designs, Russel Wright provided design and marketing assistance to many of the countries he visited. Recommendations from several of these designers validated the formation of technical training centers in several of the countries that were visited under a parallel ICA plan. The initial intent of these programs was to open up new world markets for U.S. goods, but programs like this may have done more harm than good to our industrial economic base by opening up the floodgates for cheap foreign made products.

Economic growth was accelerated by increased government spending and tax cuts during the early 1960's. President Lyndon Johnson's plan for a "Great Society" created new social programs such as Medicare and Food Stamps to spread economic benefits to more Americans. The gains were short lived, however, as the war in Vietnam and the war on poverty in America escalated past the lowered tax base. Inflation and the shortage of oil caused by the OPEC embargo of 1973 pushed prices higher, increased our dependence on imported goods and causing widespread unemployment.

“It’s not a big motorcycle
Just a groovy little motorbike
Its more fun than a barrel of monkeys
That two wheel bike
We’ll ride on out of the town
To any place I know you like

First gear (honda honda) its alright (faster faster)
Second gear (little honda honda) I lean right (faster faster)
Third gear (honda honda) hang on tight (faster faster)
Faster its alright”

- Beach Boys *Little Honda* Lyrics

By 1959 Honda was the largest motorcycle manufacturer in the world, producing 500,000 units a year. This success turned Honda's focus to another dream. The American Dream. The Super Cub C100 was the first Japanese motorcycle imported into the U.S. (Pipeline.com)





In response to fierce foreign competition, GM eliminated the divisional autonomy that helped to differentiate its models in 1984. This is largely seen as a major failure as all GM cars began to look the same. Honda's contemporary styling, efficient production methods and fuel economy helped it to grab even more market share.

The combination of steady inflation and slow business growth or “stagflation” plagued the 1970s. Consumers purchased more goods at a time, in fear that prices would continue to rise, this increase in demand pushed prices even higher. Labor demands for increased wages added to the problem and unemployment and high interest rates pushed us further into recession. President Jimmy Carter tried to combat rising inflation with even more increases in government spending and the deregulation of the airline, trucking and railroad industries. The recession lasted into 1982 when the country began a period of sustained growth.

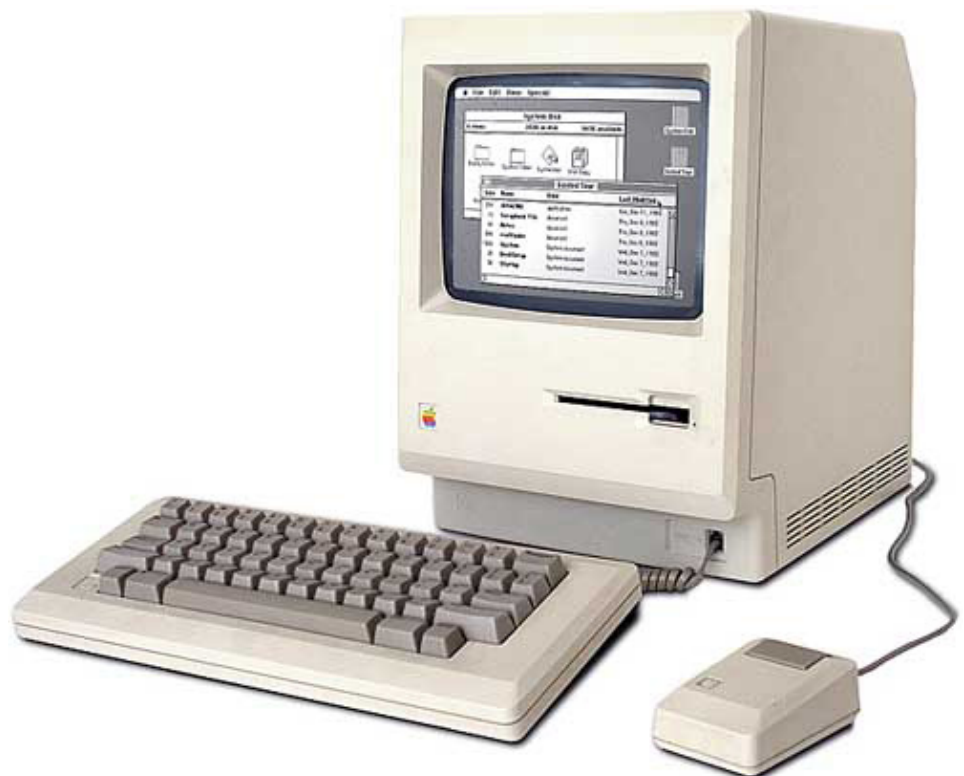
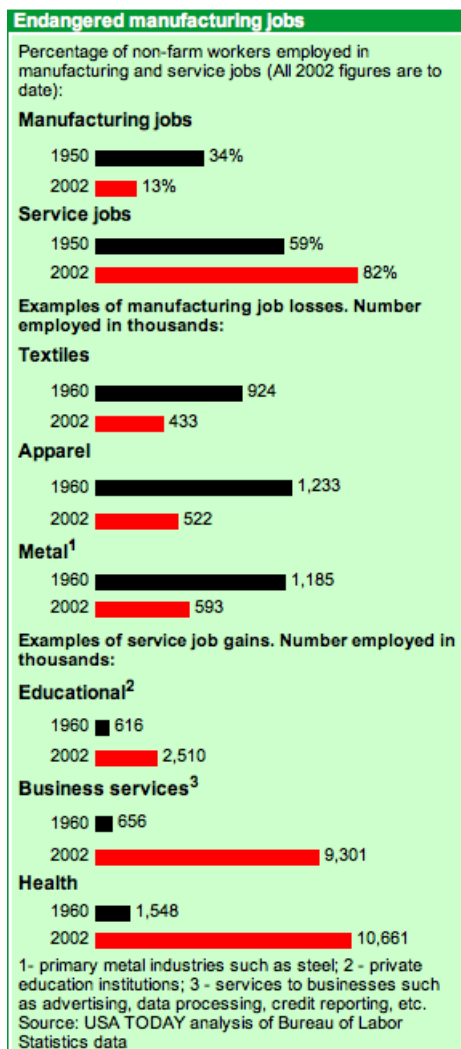
The large tax cuts imposed by the Reagan administration throughout the 1980s were criticized for only helping the wealthy. The idea of “trickle down” economics is that it would stimulate the economy by allowing the wealthy to keep more of their earnings through tax cuts so that they would reinvest more money into the system. Reaganomics favored tax cuts and reduced spending on government social programs while continuing deregulation and controlling inflation by cracking down on the supply of money. The trade deficit continued to inflate during the 1980s as Asian economies expanded at rapid rates.

The end of the Cold War, advances in communication technology and new global minded trade agreements had a major impact on the economy. The collapse of the Soviet Union opened up new markets throughout Eastern Europe. The 1990's marked the “longest peacetime economic expansion” (Conte, Carr 01) in history thanks to the growth of a global based economy. The elimination of trade barriers with efforts such as the North American Free Trade Agreement (NAFTA) along with telecommunication advances have intertwined the world in ways never seen before.

NAFTA and the acceptance of China into the World Trade Organization have helped foster a stronger global perspective on the world financial markets but some say they have also seriously hurt manufacturing here in the United States. These agreements were put in place to promote a better balance of trade but have had the reverse effect on trade. The United States imports over two trillion dollars in foreign products every year and has a trade deficit over \$700 billion. Recently there have been increases in American exports, mainly in telecommunication, computers and heavy equipment. However it is unlikely that this will have a significant effect on the trade imbalance as most of these products are used to ship even more foreign made goods back to the U.S.

Traditional manufacturing is in serious decline here in the U.S. Even though the weak dollar has made certain products more attractive to foreign buyers, increases in exports have not meant increases in manufacturing job growth. Lower wage industrial jobs have left and are not likely to return. Technical jobs in the U.S. have been increasing steadily but are not equal to the losses already incurred. RM could help increase the number of higher paying technical jobs and offset the loss of traditional manufacturing jobs. The new global economy will depend on smaller more efficient companies that can quickly adapt to new market forces with a highly skilled, flexible workforce. Emphasis will shift from mass production to more specialized customized production. The RM model could play an important role in this new economy. RM is a perfect match for low volume custom products.

USATODY 12.12.2002



Although America has lost more and more traditional manufacturing jobs to foreign competition, high tech industries such as computers have excelled. The idea of personal computing and the wide spread use of the internet has made the world smaller and its economy more accessible to individuals. The desktop computer has paved the way for more efficient smaller companies that make up the majority of our economy today.

Regional Impact

Domestic high tech industries such as computer manufacturing have been less susceptible to the pressures of foreign competition because they remain flexible to changing trends. Dell Computer was founded in 1984, offering made-to-order solutions directly to consumers. Dell Computer is the number one computer manufacturer in the world. One of the reasons for this success is Dell's localized manufacturing model. Dell uses a Design For Logistics approach to production. This is an area of supply chain management that hopes to control product line proliferation through stronger inventory management. Dell believes that several of its six worldwide production facilities make it easier to deliver custom tailored computers quickly and efficiently. Dell deliberately builds plants close to its intended end markets in an effort to shorten the supply chain. Each of these facilities carries only a few days worth of inventory versus the 12 to 20 weeks for most of its competition. These factories provide well paying technical jobs not only at Dell, but at the local businesses that support the computer giant. One significant detail to note is that each computer is built by a single individual. This modern notion of craft keeps quality at a top level. This marks the resurgence and benefits of craft into modern manufacturing.

“Local markets are best served by a localized manufacturing network”

DELL™ Buy Online or Call 1-800-WWW-DELL

Keyword Search

All Results



My Account



Premier Login



My Cart



My Order Status

You are here: USA



SAVE UP TO \$649
OFF SELECT DELL DESKTOPS AND LAPTOPS
SALE ENDS 4/28/08 @5:59AM

[▶ YOURS IS HERE](#)

1/2



Laptops



Desktops &
All-in-One



Servers, Storage
& Networking



Printers, Ink &
Toner



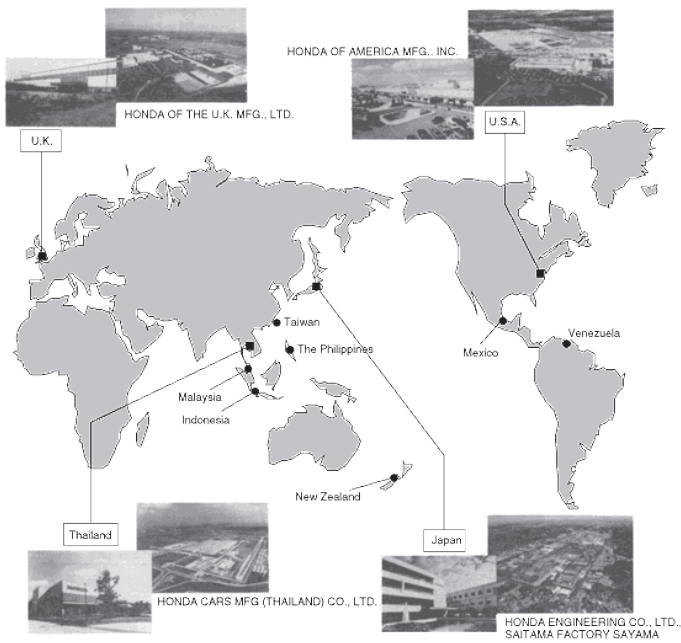
TVs, Software &
Accessories



Support & Help

Solutions For:

- ▶ Home & Home Office
- ▶ Small & Medium Business
- ▶ Large Business
- ▶ Government, Education, Healthcare & Life Sciences
- ▶ Partners



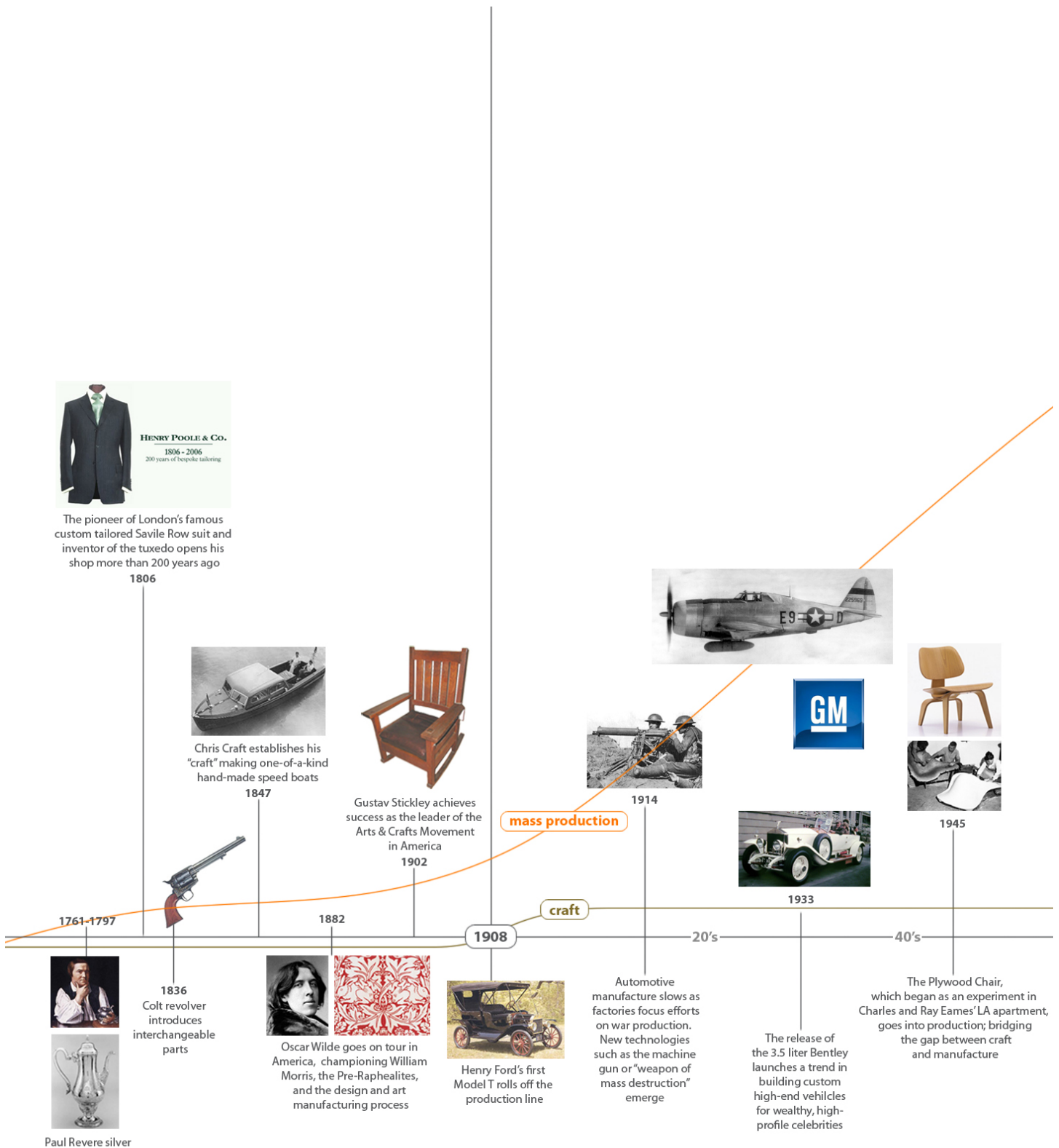
Toyota employs a worldwide manufacturing philosophy called "Just in Time." The JIT system "which means making only what is needed, when it is needed" (Toyota.com) has allowed Toyota to compete with automakers from Europe and the U.S.

Honda was one of the first companies to realize the advantages of regional manufacturing. This has made the brand more accepted in places like the United States where its Marysville Ohio plant supports the local economy while providing reliable transportation at a competitive price. The lack of international shipping and import tariffs helps make these products more affordable.

Dell's newest factory in North Carolina has spawned at least seven new logistics, packaging and automation firms in the surrounding area.



Craft vs. Mass Production: A Timeline

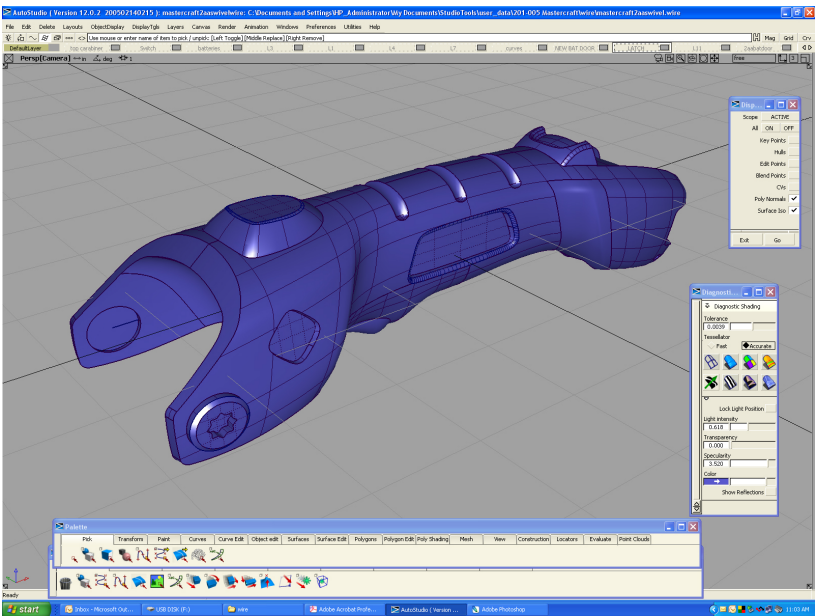


Technology Advances Lead to the Future of Manufacturing

Visualization and modeling have always been an important part of the product development process. Models are used to test ideas, human factors and aesthetics before committing to final production. Industrial designers use several different types of models for different things during the design process. Models may be used early in the process to study and communicate the basic use, scale and function of a specific design concept. These models might be made of cardboard, foam board, clay, foam or wood and are sometimes called “Frankenstein” models because of their crude construction. These models are strictly for learning and are usually discarded after they have served their purpose. Once a concept or series of concepts is decided on, more refined models may be created to more accurately evaluate the direction. Traditionally, these models were made by hand of wood or plaster by a skilled model maker. This process really began to change with the advent of computer aided design or CAD during the 1980’s. CAD became the standard, first in 2-D with software like AutoCad and later in 3-D with programs like Pro Engineer. Rapid prototyping technology or 3-D printing developed in parallel with the rise of computer aided design (CAD) techniques. Today, 3-D printing has become an integral part of the product development process and has all but replaced the need for hand made samples.

The following section presents the different additive fabrication processes that are currently used for rapid prototyping. These technologies are on the front lines of the future of manufacturing and will be the basis for RM. The advantages of these processes is their ability to create accurate, dimensionally stable plastic parts from 3-D data in a fraction of the time it takes for similar injection molded parts. These processes are most effective when creating low volume custom parts. These processes do not use any tooling or fixtures so changes can be made right up to the point when you hit Print. This attribute fits the RM model perfectly. Technical operators can make changes real-time at the whim of the consumer.

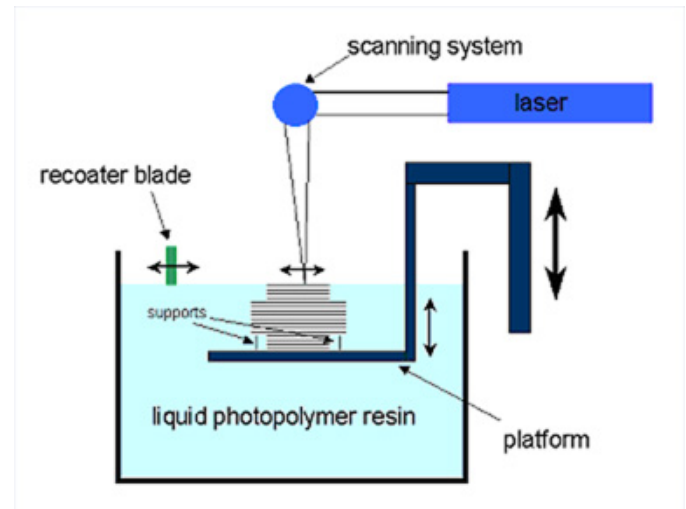
All rapid prototyping begins with a 3-D CAD model.



This chart compares pros and cons of different rapid prototyping processes. (xpress3D.com)

RP PROCESS COMPARISON					
Most of the rapid prototyping processes can create parts from multiple materials. The chart below provides a rough comparison of various applications and uses, based on an average rating of the materials used in the specific process. The lower the number the better the rating. See our materials comparison for more detail.					
Accurate	PJET	ZCorp	FDM	SLA	SLS
	1.00	1.00	1.00	1.13	2.00
Feature Detail	PJET	SLA	ZCorp	FDM	SLS
	1.00	1.00	2.00	2.40	3.00
Strong	SLS	FDM	PJET	SLA	ZCorp
	1.00	1.40	2.33	2.50	3.00
Smooth Surface	PJET	SLA	ZCorp	FDM	SLS
	1.00	1.00	2.00	3.00	3.00
Functional Testing	FDM	SLS	PJET	SLA	ZCorp
	1.00	1.00	1.67	1.88	3.00
Semi-transparent	PJET	SLA	FDM	SLS	ZCorp
	Yes	Yes	Yes	No	No
Flexible Materials	PJET	SLA	FDM	SLS	ZCorp
	Yes	Partial	No	No	No
Colors	FDM	ZCorp	PJET	SLA	SLS
	Yes	Yes	Yes	No	No
Multiple Colors Within Part	ZCorp	FDM	PJET	SLA	SLS
	Yes	No	No	No	No
SLA	Stereolithography		Z Corp 3D Printing		
SLS	Selective Laser Sintering		Polyjet		
FDM	Fused Deposition Modeling		PJET		

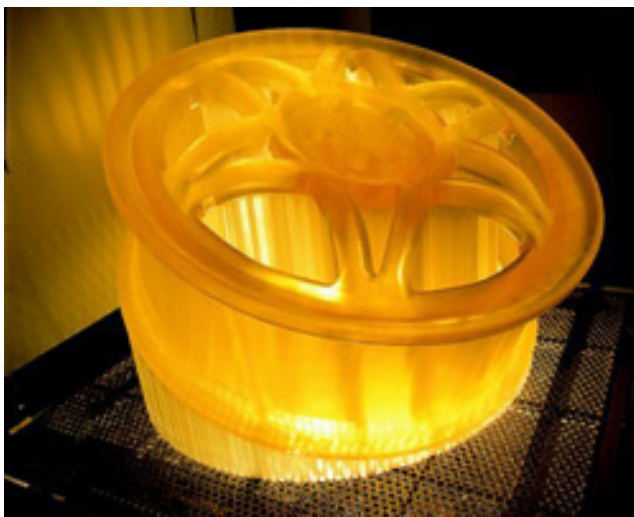
Stereolithography (SLA)



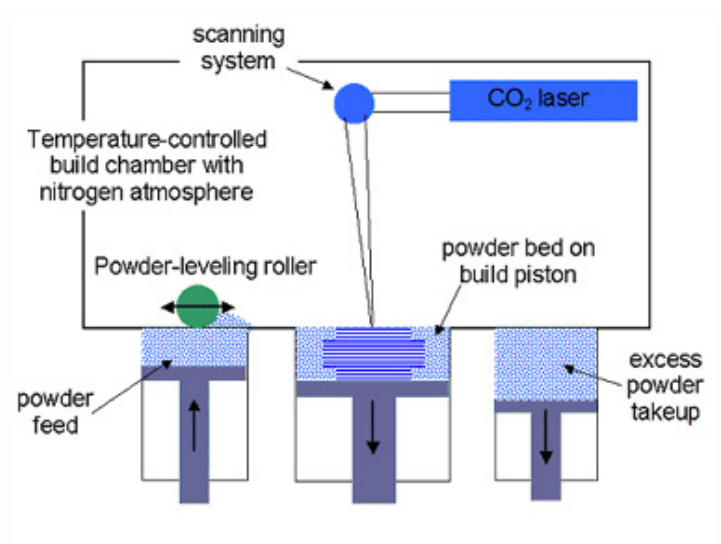
A small company in California named 3D Systems invented the first additive fabrication process called Stereolithography or SLA in 1986. SLA has become the industry standard and is the most widely used rapid prototyping system in the world today. SLA, like all rapid prototyping systems, begins with a three dimensional (3-D) CAD model that is referenced by the system's software to create a physical copy of the data. The system consists of a tank of photosensitive liquid resin that is hardened by exposure to a laser in thousandths of an inch layers. The part is created as the layers build on a platform that lowers deeper into the tank. This perforated platform is raised after the part is completed to allow excess resin to drain. The part is cured as necessary and removed. The layering process creates a series of small steps that are easily hand sanded away. Material selection is limited but recent advancements have improved the properties to be more like real plastic.



An SLA part ready to be removed from the machine.



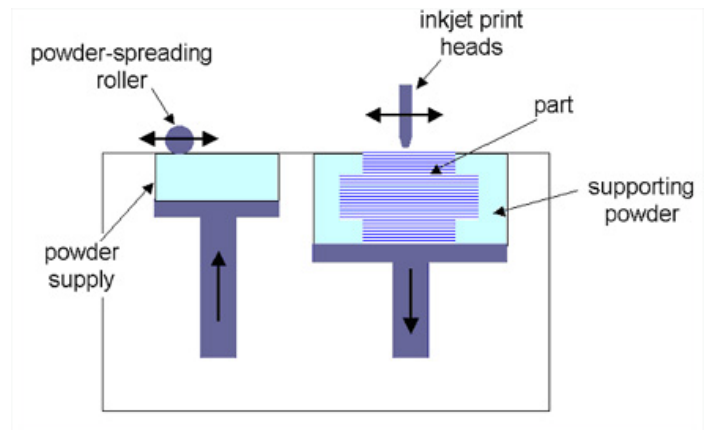
Selective Laser Sintering (SLS)



Selective laser sintering or SLS is another additive fabrication technology that uses a layering process similar to SLA. The main difference is the material. SLS uses a powdered material that is fused together with a carbon dioxide laser. A thin layer of powdered material is deposited onto the build platform or piston and the laser traces the part's cross section, the platform is then lowered as the part is constructed. When the part is completed it is in the form of a cake, the excess material is blown off to reveal the part. The process was developed at the University of Texas and first commercialized by the DTM Corporation. DTM shipped the first Sinterstation in 1992. The SLS process core advantages are its strength and ability to use metal powders to create real metal parts that have nearly identical properties to a cast or machine part.



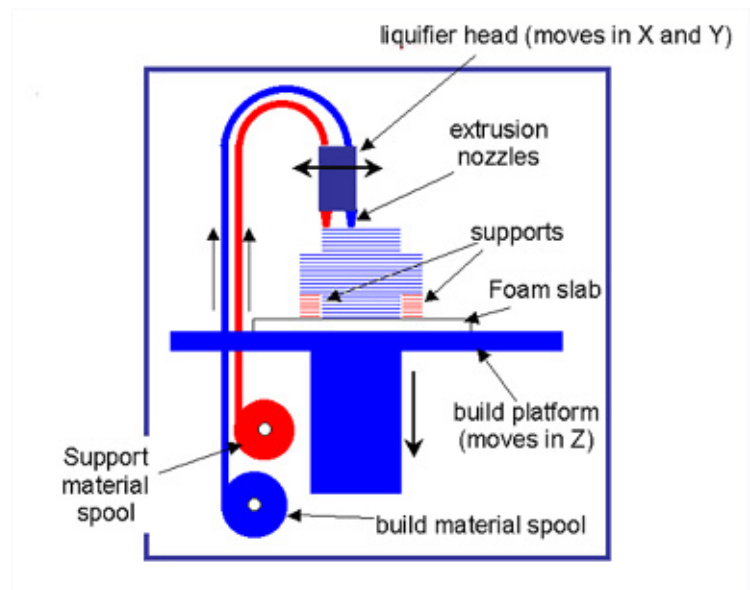
Z-Corp 3-D Printing



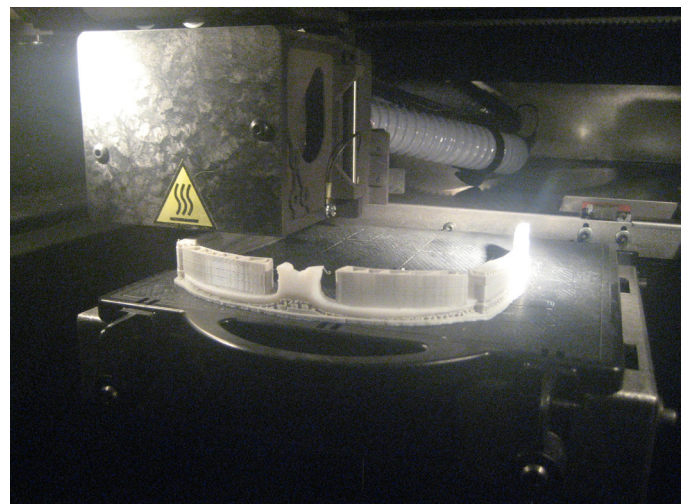
Z-Corp's 3-D printing process is a cross between selective laser sintering and ink jet printing. It is considered one of the fastest and most cost effective additive fabrication systems. It is used primarily as a design visualization tool and can create a model of mobile phone in less than an hour for as little as \$10. The process is similar to SLS in that it uses a powder as its base material but instead of using a laser to fuse the material together, it sprays a binding agent (cyanoacrylate or super glue) after each layered pass to hold the material together. Like SLS, it does not need to build a support structure, as the un-fused powder becomes the support. The inkjet technology used in this process allows for multiple colors but the material selection is limited to either a starch based or a plaster based powder. The accuracy, strength and surface quality of the parts are relatively weak compared to other systems, however, the starch based material can be used to create investment casting molds without the use of a pattern. This allows you to pour molten metal directly into a printed cavity to produce metal parts quickly.



Fused Deposition Modeling (FDM)



Scott Crump invented fused deposition modeling (FDM) in 1989. FDM is an additive fabrication process that creates parts from real production grade thermoplastics such as ABS and Polycarbonate. This point of difference is what really separates FDM from all of the other rapid prototyping methods. The system uses heated nozzles inside a heated environment (reduces energy needed to melt the plastic) to extrude molten material in thin cross sectional layers on a vertically moving platform “akin to using a hot glue gun to make parts.” The nozzles are fed by thin filament material housed in separate cartridges, one for build material and one for support material. Once the part is complete the support material is removed and the part is ready for use. There are currently two different types of support material, one is broken away from the final part and one is dissolved away in a chemical bath. FDM parts are one of the most accurate and strongest (only SLS is stronger) of any additive fabrication process (up to 80% of injection molded parts) and are completely functional without any secondary processes. The drawbacks of FDM are the surface quality and the build time, which can be considerable depending on complexity.



“FDM is taking on increasing importance as an alternative manufacturing method for components made in small numbers.”

Günter Schmid, BMW (Stratasys)



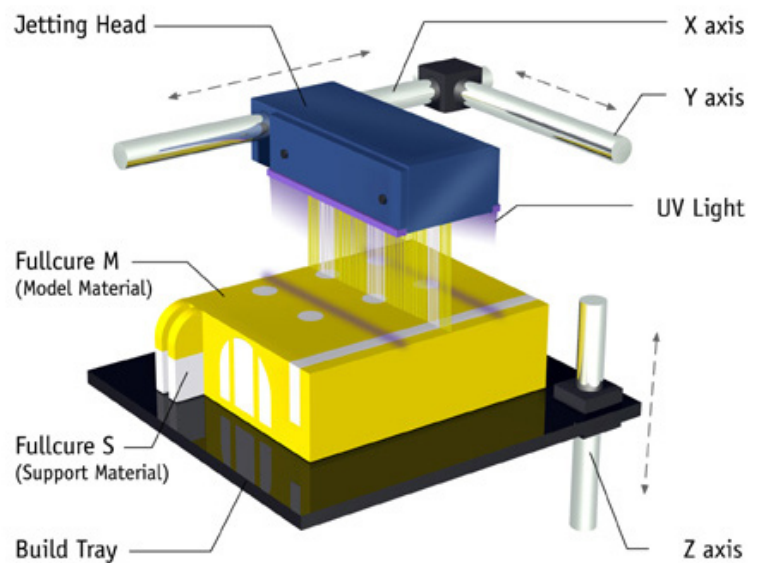
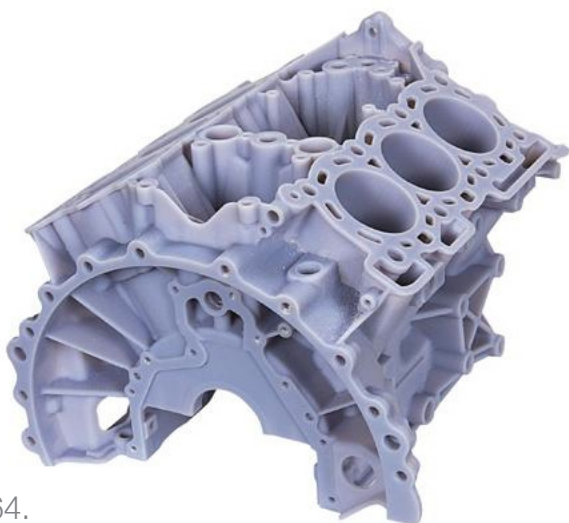
BMW uses FDM to create complex hand assembly jigs & fixtures at the new plant in Leipzig Germany. Fixtures such as these would normally take 4-6 weeks to machine but only hours with FDM. The technology has improved productivity, ease of use and ergonomics. FDM's lack of constraints allows for a new design freedom not seen with conventional methods.



Polyjet



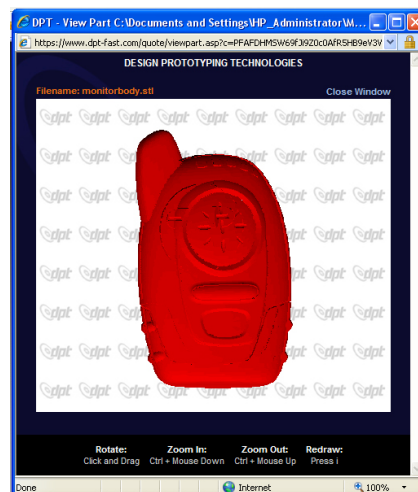
Polyjet, one of the newest additive fabrication processes is a culmination of several of the aforementioned methods. Developed by Israel's Objet Geometries in 1998 and distributed exclusively in the U.S. by Stratasys, Polyjet uses inkjet based technology to deposit layers of photo sensitive material on a vertically moving platform which are immediately cured with UV light with each pass of the print head. Once a part is completed the gel-like support material is washed away with a water jet. The system prints in .0006 inch layers (1/5 of SLA) making it one of the most accurate modelers with the highest quality surface finishes. Polyjet can also create flexible parts as well as semi-transparent parts.



Rapid Prototyping Houses, Model Shops and Fab Labs

The machines and technologies presented on the preceding pages are used extensively throughout the product development process. Many companies have some of this technology “in house” and either own or lease the machines. These technologies are in a constant state of change, which can make staying up to date difficult and expensive. Companies such Design Prototyping Technologies (DPT) of Syracuse, N.Y., has used this fact as the basis for a successful business model. DPT provides a variety of rapid prototyping services including SLA, SLS, FDM, and most recently Polyjet as an outsource option to many corporations and design/engineering professionals. The company uses an interactive website that can instantly create real time price quotes by uploading a 3-D model. The site allows you to select from several different materials, processes, finish levels and shipping methods. DPT is one of the most recognized rapid prototyping facilities in the country and can ship anywhere in the world.

DPT's online quote engine makes ordering custom parts fast and easy. Once registered, you upload .stl files to the site, pick your process, material and finish to get instant pricing. The part can be viewed in an interactive 3-D window that confirms its size. Ordering is just a mouse click away.



Copesetic Inc. of Morrisville, N.Y., is a traditional industrial design model shop which can provide CNC machining, light assembly, and urethane casting. Copesetic specializes in appearance models and working prototypes but can also supply low volume production for sales samples or product testing. Part files are sent via email directly to the facility where technicians evaluate the data to decide the best process to use. Copesetic works closely with DPT and uses RP technology for complex parts that could be too difficult to machine. Both of these companies represent commercially viable localized manufacturing techniques for a small custom market. Copesetic is also the largest employer in Madison county, providing well paying technical jobs.

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Incodema is a sheet metal fabricator located in Ithaca, N.Y. They specialize in prototyping and low volume production. Cutting, forming, embossing, draws, gussets, coining, welding, plating, anodizing and heat treating are just some of the sheet metal processes offered.

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The MIT Fab Lab is a community outreach program that focuses “around the emerging possibility for ordinary people to not just learn about science and engineering but actually design machines and make measurements that are relevant to improving the quality of their lives.” MIT currently supports 13 Fab Labs worldwide. Each lab has a series of machines that can help regular people make almost anything that they can imagine. In fact, Neil Gershenfeld, the director of MIT’s Center for Bits and Atoms actually offers a class titled “How to Make Almost Anything” Gershenfeld states in his book Fab that “Personal Fabricators (PF’s) are about to revolutionize the world just as personal computers did a generation ago.”

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Images showing various 3D printed parts, a person working at a machine, and a circuit board.

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SCIENTIFIC AMERICAN FRONTIERS

Title: A Factory on Your Desk

Date: 04-08-2003
Episode: You Can Make It On Your Own

- More segments from this episode

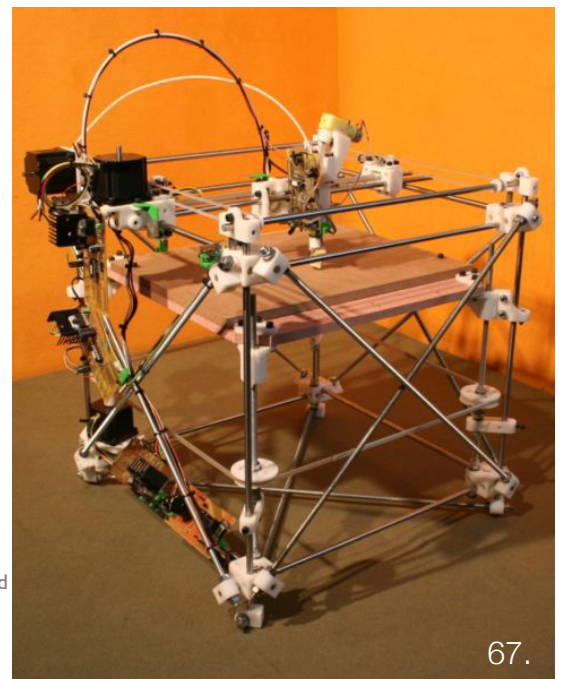
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Actor Alan Alda spends time at the MIT Fab Lab. In this photo he is evaluating his working prototype of a "red eye" reducing flash periscope for a camera. User content continues to expand with some experts predicting; that just as the personal computer and desktop publishing revolutionized printing the same thing will happen with personal fabricators.







Researchers at the University of Bath in the UK have developed the first self replicating 3-D printer that works at room temperature. The RepRap (Replicating Rapid Prototyper) can copy itself and be built for around \$800.

Direct Digital Manufacturing (DDM)

DDM is the future of product procurement and could be considered the “next industrial revolution.” DDM allows for faster production, smaller capital investment, unlimited complexity with few manufacturing constraints and revisions can be made without penalty. The whole manufacturing model becomes more streamlined and efficient. Eliminating the need for tooling means that production can begin immediately, parts are made in days not months. No tooling means less up front expenditure reducing costs usually amortized into the price of the finished product. The idea of lower volume, more customized, on demand production runs, can simplify inventory control and reduce distribution and warehousing costs. DDM technology helps make RM possible. The same machines used in DDM will be used in RM, but the environment will change from factory to storefront.

Stratasys is on the front lines of DDM. Several parts on its RP machines are actually created using DDM. The bezel, door handle, material bay handle and certain spacers are all made through FDM technology. Stratasys saved over \$100k in tooling alone for these parts and they were made in less than 2 weeks.

Scott Crump, CEO of Stratasys recently gave a webinar on the potential for DDM and the use of FDM technology.

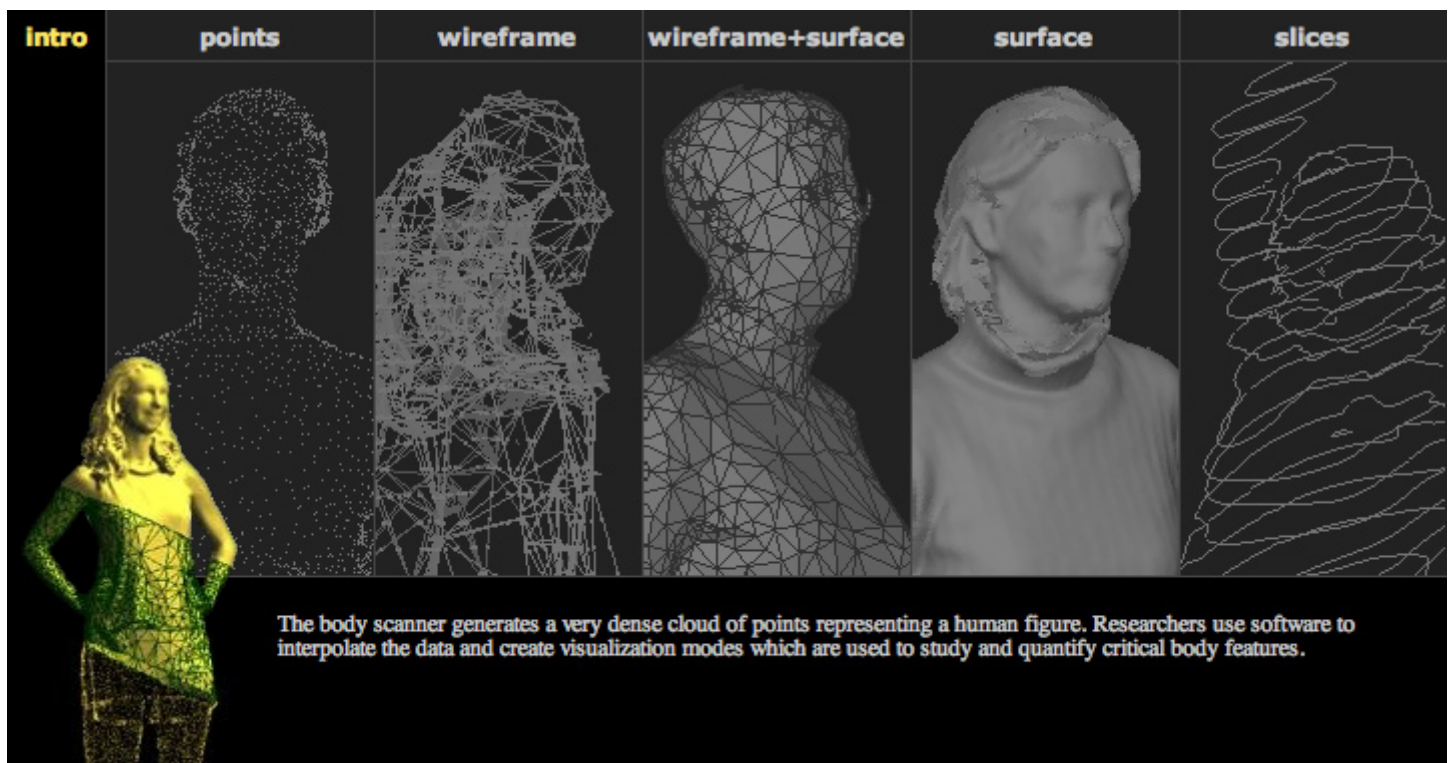
<div><h3>5 Key indicators</h3><ol style="list-style-type: none">1. Complexity2. Large initial investment<ul style="list-style-type: none">– Money and time3. Potential for redesign4. Customization<ul style="list-style-type: none">– Added value in customization<p>Direct Digital Manufacturing is Here Now. www.stratasys.com</p></div>	<div><h3>Advantages of DDM</h3><ul style="list-style-type: none">• Rapid deployment<ul style="list-style-type: none">– No tooling– Production starts immediately– Manufacture parts in days not weeks• Smaller investment<ul style="list-style-type: none">– No tooling cost<p>Direct Digital Manufacturing is Here Now. www.stratasys.com</p></div>
<div><h3>5 Key indicators</h3><ol style="list-style-type: none">5. Low production volume<ul style="list-style-type: none">– Annual volume in cubic inches– Large number of small parts– Small number of medium to large parts<p>Direct Digital Manufacturing is Here Now. www.stratasys.com</p></div>	<div><h3>Considerations</h3><ul style="list-style-type: none">• Low production volume<ul style="list-style-type: none">– One to thousands• Accuracy<ul style="list-style-type: none">– $\pm 0.005"$ or greater• Repeatability<ul style="list-style-type: none">– Slight variance between runs• Surface finish<ul style="list-style-type: none">– Secondary operation; internal parts<p>Direct Digital Manufacturing is Here Now. www.stratasys.com</p></div>

3-D Imaging

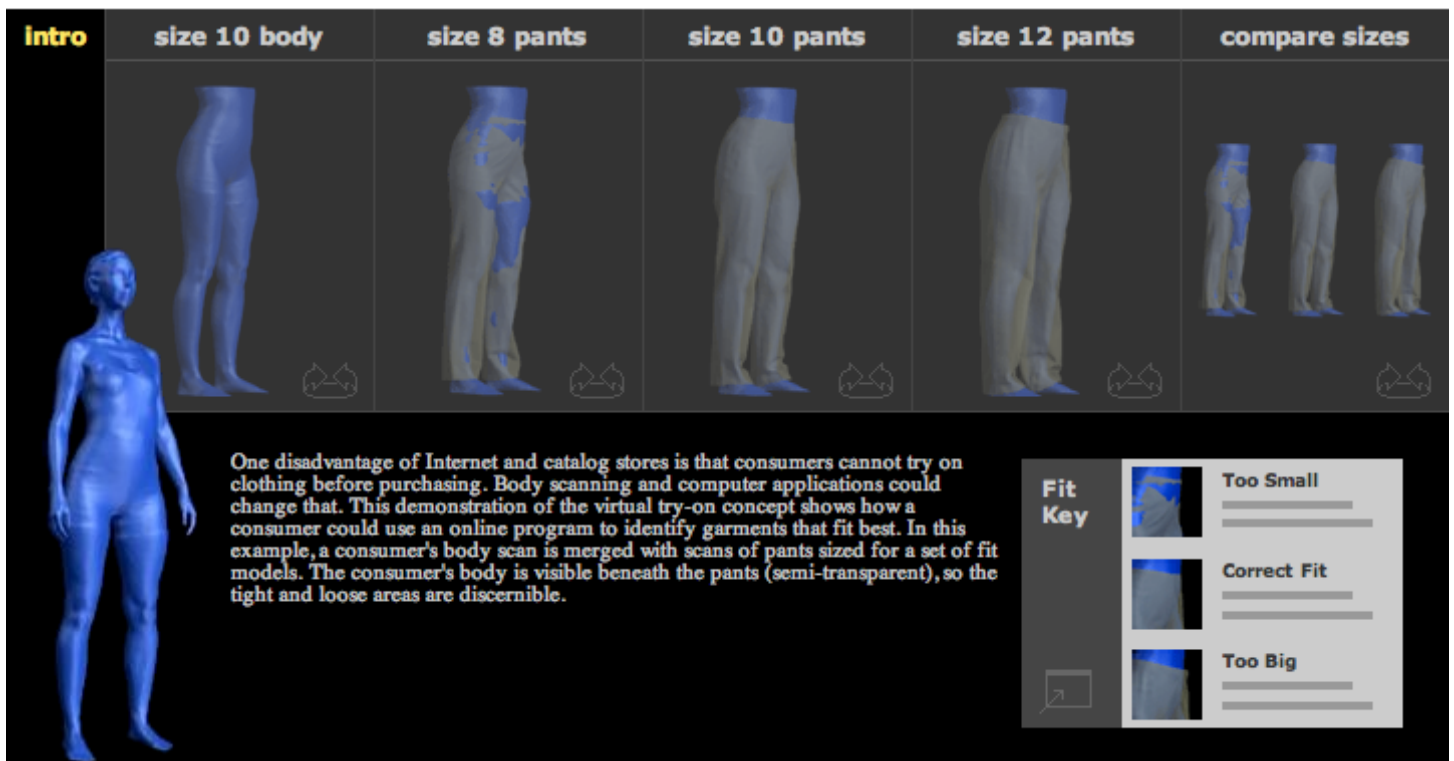
BODY SCANNING IS A NEW TECHNOLOGY that is helping to shift the focus of apparel production from large quantities of cookie-cutter clothes to one-of-a-kind articles with individualized sizing and design features. A suite of technological advances, including body scanning, has given rise to an emergent strategy of “mass customization” -- bringing consumers into the design and production stages, resulting in well-fitting, made-to-measure garments at competitive prices and turnaround times.

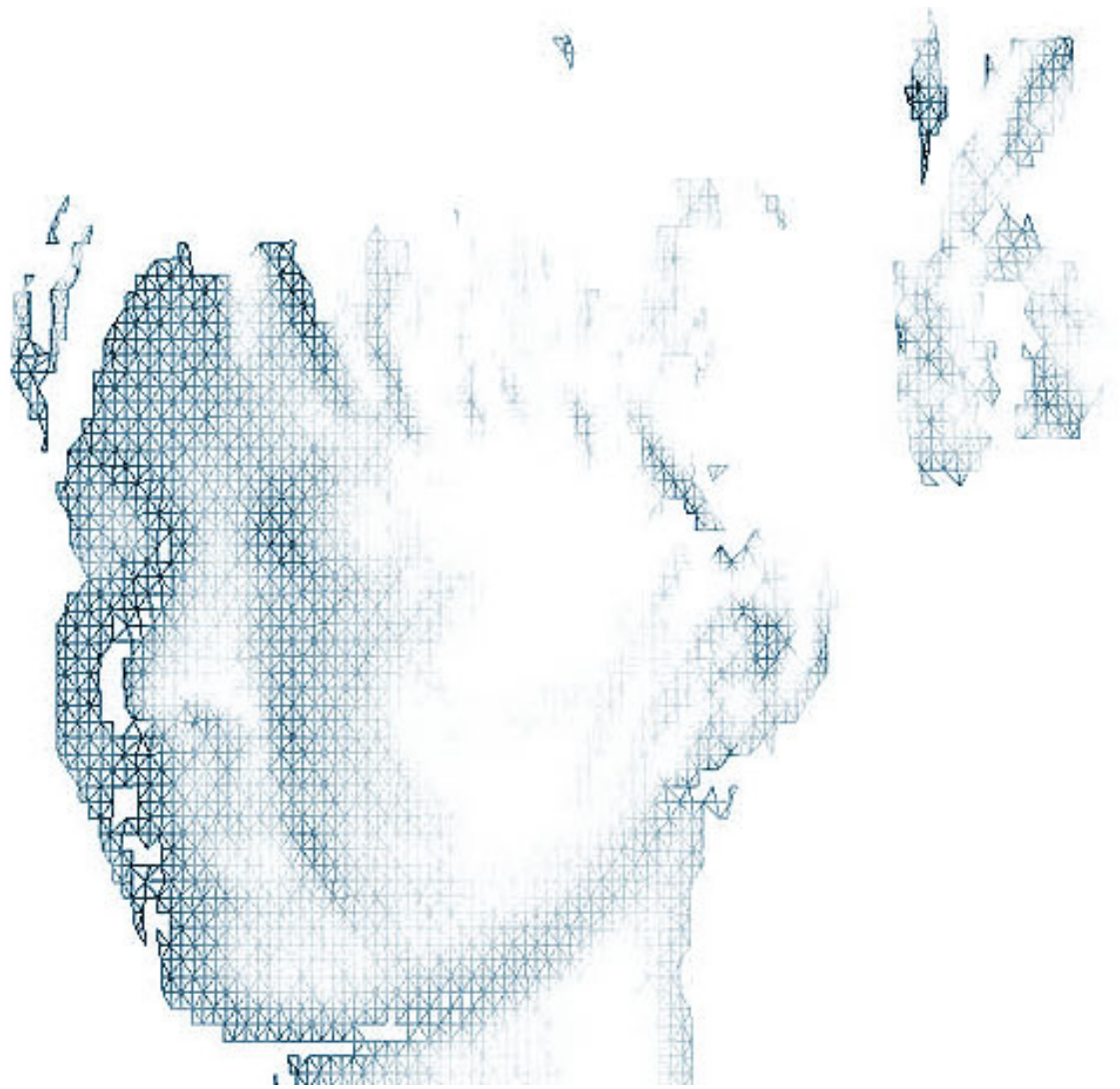
-<http://www.bodyscan.human.cornell.edu/scene60df.html>





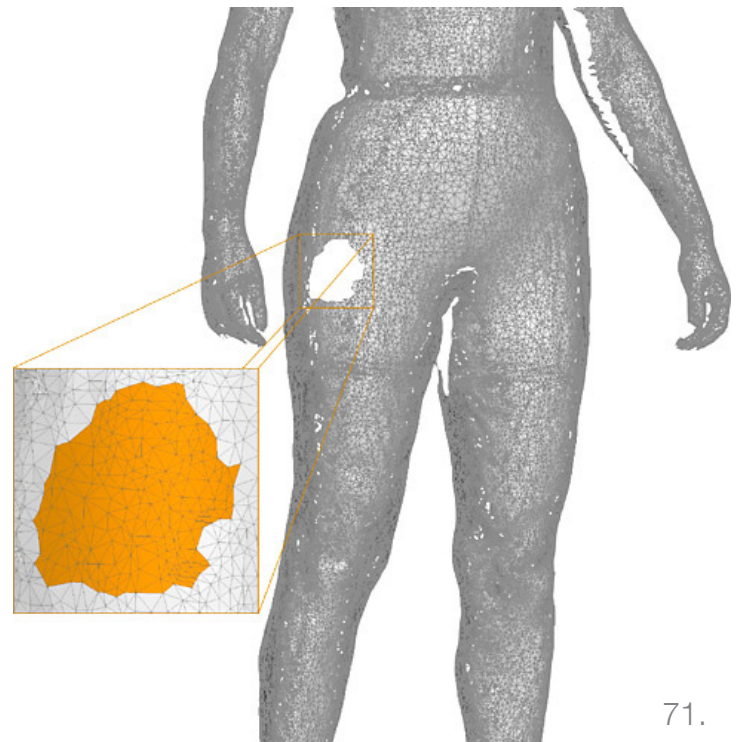
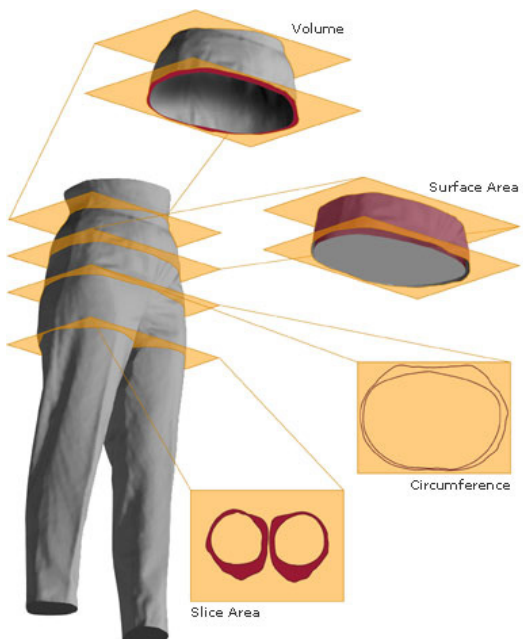
Researchers at Cornell have been using 3-D body scanning technology to provide better fitting clothing



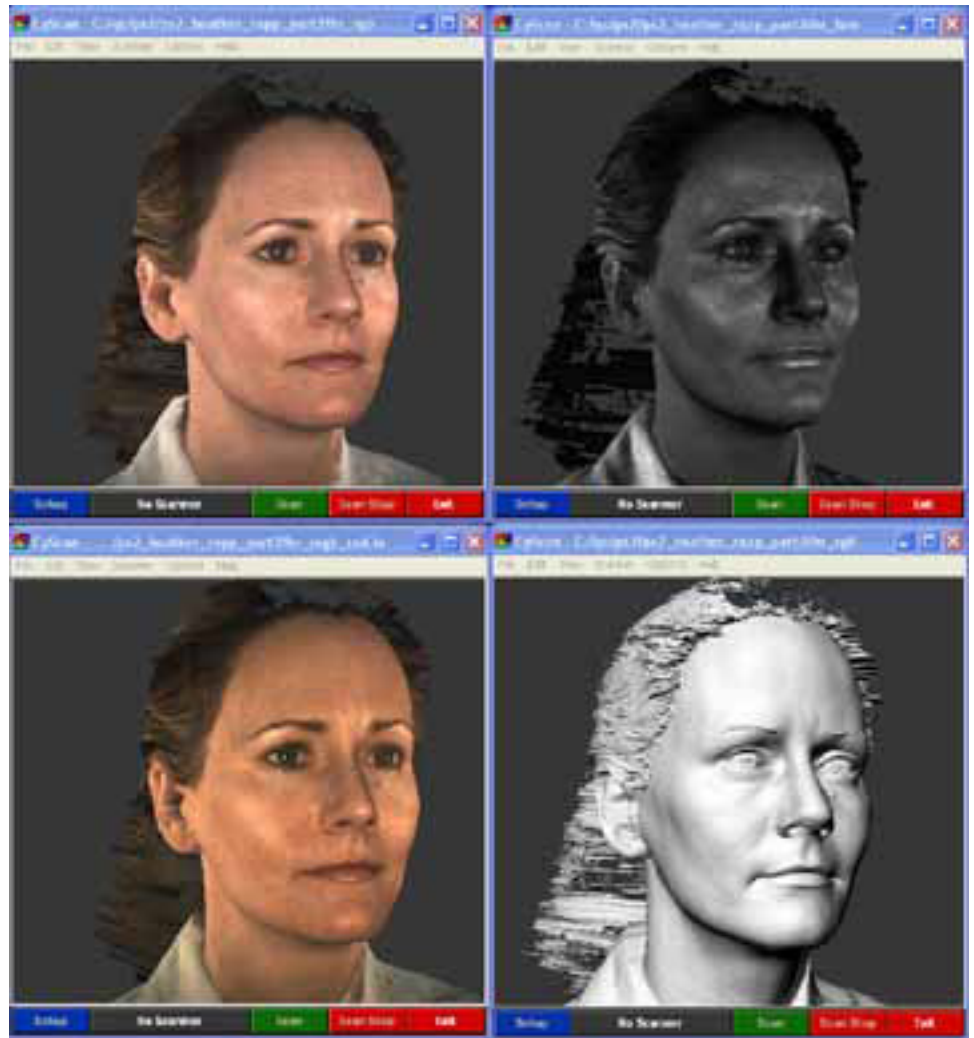


Visual representations of 3-D body scans.

Cross sections show fit improvements.



Face scanning technology has been pioneered by the Cyberware company and has been used for everything from the movie industry to the medical industry.



Localization

Products manufactured locally tend to have a loyal regional following. This helps support the idea of localized manufacturing and proves that it can be economically viable. Imagine you are given the opportunity to choose between two competitive products, each are equal in price, performance and aesthetic. One is manufactured by a company in your hometown where your uncle is employed and one is manufactured by a company in another country where you do not know any of the employees. Which product would you be more likely to purchase? The product that is made by your uncle of course! In essence that is the appeal of locally produced products.

Budweiser has a strong local product loyalty in the Central New York area thanks to the Anheuser-Busch Baldwinsville, N.Y., plant, even though it is a national brand its presence supports the local economy. Budweiser understands the benefits of having manufacturing plants close to end markets. There are 12 plants in the U.S., each one supporting its local regional area. The plant in Baldwinsville has its own waste water treatment plant, recycles almost all of the waste it creates and uses local companies to supply everything from glass to aluminum cans to cardboard packaging. This one plant has a far reaching impact on the local area not just through direct employment of its own workers but through the workers at the companies that support it.

In an effort to promote more product loyalty, select Budweiser employees are given “Bud Cards” which are prepaid credit cards to be used to buy people Budweiser products when they are out on the town. ConAgra foods has a similar program where instead of credit cards, employees are armed with stickers to place on restaurant receipts that say “Thank You for using ConAgra Foods products” or “Wish you were serving ConAgra Foods products!” Both of these programs are a way to make the local community aware of their presence and impact on the economy.

Many areas of the country make their own local potato chips. In Syracuse it is Terrell's.



Anheuser-Busch's Baldwinsville, NY Plant.





Starbucks realizes the value of appearing local. This London store blends into its surroundings as though it has been here for 100 years.

The BuyNY Program is a state funded program to promote local NY companies.

Benefits of Destiny USA

BuyNY Program

The BuyNY program will be triggered to place billions of dollars of purchases and contracts for goods and services with New York companies. Not only will the billions of dollars in new business add jobs and economic impact, it will elevate the capabilities and global competitiveness of the supplier firms. There are thousands of New York companies which could enhance their future through the BuyNY program. By way of example, Destiny USA's workforce will rely on handheld technologies created and manufactured by a Central New York firm.

Training is being sourced locally/regionally extending to Rochester

Locally produced Handheld device used by construction team

The city of Ithaca NY began printing its own currency, the “Ithaca Hour” since the 1990’s to help keep money within the local economy. The system is based on hours of local service.





Eating foods sourced within a 100 mile radius of your home has become a way of life for many on the West Coast of the U.S.



Garden Gate is grocery delivery service in Ithaca, NY that specializes in local food products.

On its way from farm to plate, food in the United States travels an estimated 1,500 to 2,500 miles, 25 percent farther than in 1980, according to Worldwatch Institute, a Washington-based environmental nonprofit organization. (O'Donnel 01)

According to the 2004 National Farmers Market Directory published by the Agriculture Department, there were 3,706 farmers markets on record in 2004, more than double the number in 1994. This one is in the Soulard area of St. Louis MO.





Custom

“...individualistic design solutions often remain the preserve of the wealthy elite... new technologies are becoming widely available that would appear to be offering the means by which these two camps can be finally reconciled. The future of design may thus lie in the creation of universal solutions that can be efficiently adapted to meet individualistic needs.” - Designing the 21st Century (Fiell 23)

Niche markets for products and services have greatly expanded through recent communication advances. New connections between buyers and sellers are happening every second through websites like eBay and Amazon. More and more people are becoming entrepreneurs as the Internet has created an infinite number of distribution channels to sell to specific consumers. The idea of individuality and personal identity has created a demand for custom-made products never seen before.

Car enthusiasts have been modifying and customizing cars since they first appeared on American roadways over a hundred years ago. Custom coach building was traditionally reserved for only the wealthy but has become increasingly accessible to ordinary consumers through advances in communication and technology.

Notice that this custom motorcycle was made specifically for the “FedEx Guy” by Jesse James of West Coast Choppers in Long Beach, CA.

Clint Cope uses his industrial design background to create advanced speed equipment for his Mini Cooper. This super charger plenum was made using a reinforced SLS process.



This is a photo of the 1940 Ford pickup that I have owned for over 20 years. It is currently going through its second frame off restoration. The work is being performed to my personal specifications by Weldon Richardson, an Amarillo Texas Hotrod builder who specializes in 1940 pickup trucks.



choppers | CUSTOM BIKES | FEDEX GUY



© 1997-2005 West Coast Choppers, www.westcoastchoppers.com

GALLERY DESCRIPTION
Owner: FedEx Guy

GALLERY DETAILS
FedEx Guy
Credit: Eric Harmeister

◀ 01 of 15 ▶

The Millennial Consumer

“In just a few years, the Internet has revolutionized the way the world does business. It has already triggered the move from ‘mass production’ to ‘mass customization’. In fact, almost anyone with a product idea can sell goods directly over the Web. Entrepreneurs don’t have to wait for a retailer to carry their products.”

–Lunar Design (quoted in Fiell 307)

A historic characteristic of American materialism is that average consumers wanted inexpensive products with little regard to durability and longevity. This attitude is beginning to change as a new generation is realizing the implications of a wasteful, throw away society. Stronger awareness of current manufacturing ills will demand a new model. This new consumer is concerned with how the products they use impact the environment and that they were produced ethically. This consumer has been raised in an instant gratification society where products are ordered with the click of a mouse and delivered directly to their front door. Technology permeates every aspect of this consumer’s existence, where new ways of doing things happen almost daily. This consumer has been able to express their individuality to the rest of the world through personal web-blogs, websites and social networking websites. This generation is used to projecting themselves to the world and custom products will become another extension of that projection. This consumer is less resistant to change and will quickly embrace a new model like RM.

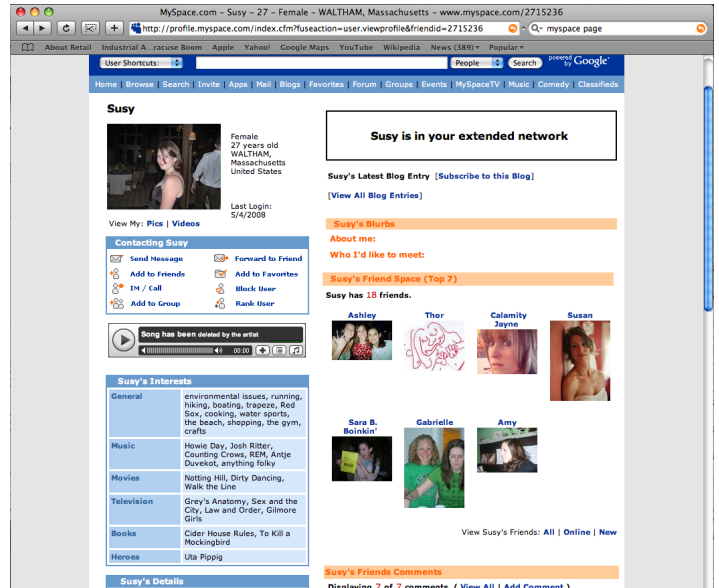
RM will allow these consumers the higher degree of participation in the design process that they crave. When the consumer is involved in the design process it gives them a new sense of ownership in the product. Because of this ownership, the user is more likely to repair a product that they contributed to versus throwing it out.

Today everyone wants to be a designer. Celebrities portrayed in advertising campaigns make the process seem transparent and easily accessible to anyone. Does Shaun White actually design his own line of snowboards? Maybe, but what is his definition of design?



The video game Doom was one of the first to allow users to actually write their own levels. This type of open source architecture is attractive to the millennial consumer.

Social networking sites like Myspace and Facebook allow users to express themselves to the world.



You Tube has allowed anyone to present a video to the world.


The do-it-yourself industry has spawned big box retailers like The Home Depot and Lowes. This further supports individualistic endeavors by consumers.



HP's latest advertising campaign features different celebrities discussing the ways they use their computers. Designing their own products gives ordinary consumers inspiration to do the same.

Shaun White

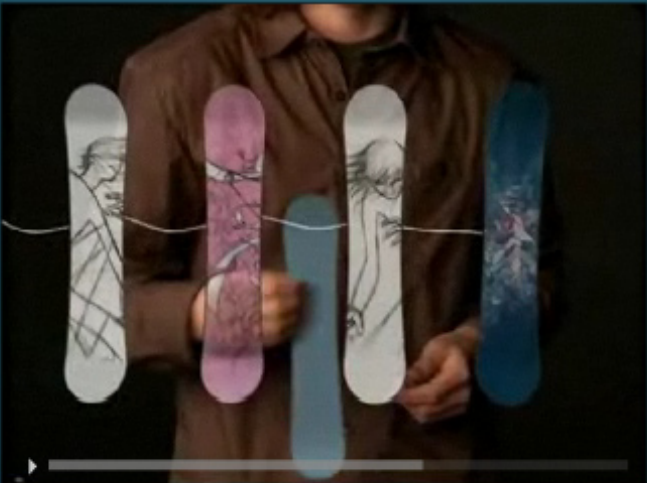
MASTER OF SNOWBOARDS, GOLD MEDALS, GRAVITY



» Go deeper, explore Shaun White's computer

Shaun White

MASTER OF SNOWBOARDS, GOLD MEDALS, GRAVITY



» Go deeper, explore Shaun White's computer

Case Study: Nike

Nike has been creating products people want since the late seventies and in the late 1990's they developed the NikeiD (individually designed) website that allowed users to create their own (if somewhat limited option) custom athletic shoes and messenger bags. Using a web interface, a custom product is created and shipped to you within a few weeks. This has been taken one step further with the launch of the NikeiD Studios in London and New York, where you meet face to face with a design consultant (term used loosely) and they help you pick the colors/materials for your personalized model. The product is made to order then shipped to you in about four weeks.





Nike ID Studio in London, UK.



Case Study: Cold Stone Creamery

Who doesn't like ice cream? I like all kinds of ice cream, peanut butter and chocolate now that's my favorite. Ben & Jerry's makes a great peanut butter cup ice cream, French vanilla with real mini Reese's cups. As good as it is, could there be more peanut butter cups? When I was a kid Baskin Robbins was the place to go, with over 31 flavors, you were bound to find something you liked. Now when you go to the ice cream stand or grocery store you can choose from what seems like an infinite selection of ready maid ice cream flavors but none are quite as good as making my own custom made sundae. I think my favorite is vanilla ice cream covered in chocolate syrup, dry roasted peanuts and sometimes peanut butter. Well that was my favorite until I was recently introduced to Cold Stone Creamery. I first thought that this was just another typical ice cream vendor at the mall, but to my surprise it was actually a mini ice cream factory crafting up custom Creations (trademark name) of ice cream just the way I like it and they have been doing it since 1988. You choose the base ice cream and then your personal ice cream craftsman scoops the ice cream onto the chilled mixing slab granite stone where an infinite number of ingredients are combined in front of your eyes. What ever you can think of is on display in front of the mixing slab, you want gummy bears and hot fudge, you got it, pralines, pistachios and caramel, yep. Your own personally customized, one of a kind mouth watering treat made right in front of you.





One of a kind sundaes made in front of your eyes.

Case Study: Build-A-Bear Workshop

Build-A-Bear Workshop is a great example of retail enabled, mass customization. The real twist is the emotional tie associated with creating your own one of a kind stuffed animal, complete with heart. The consumer begins by picking out the base animal, which can be anything from a bear to a dinosaur. The toy is next given its voice by picking out the sound component. A store representative works with the consumer to add stuffing and the ever-important heart. The toy is sewn up and the consumer can continue to pick accessories such as clothing and hair. Finally the animal is given a birth certificate and purchased.

Weird but one of a kind.



MY FURRY FRIEND IS SPECIAL. I BROUGHT IT TO LIFE
I CHOSE IT. I STUFFED IT. I MADE IT MY OWN.
I PROMISE TO LOVE IT AND GIVE IT A HOME.

DATE OF BIRTH:	3/26/2008
FULL NAME:	BETSY-SUE
HEIGHT:	16 INCHES
WEIGHT:	9 OUNCES
FUR COLOR:	YELLOW
EYE COLOR:	BLACK
BELONGS TO:	KIMBERLY SUNTRUP

SAINT LOUIS
GALLERIA

Melanie Clark
Chief Executive Bear





Adding a heart really gives life to the product and creates an emotional bond.

Case Study: Lenscrafters

Lenscrafters is a probably the closest thing to a true retail manufacturer. The store creates custom made eye glasses in “about an hour.” The glass wall at the back of the store helps make the process transparent to the consumer. The consumer meets with a store associate who helps them decide on the right frame, measures their eyes and helps them decide on options. This personalized service allows the consumer to participate in the process, giving a true sense of ownership in the final product. What if Lenscrafters used face scanning technology to create a digital representation of your head to get a more exacting fit? Could Lenscrafters use rapid prototyping technology like FDM to create a one of a kind frame?

Lenscrafters is very close to being a Retail Manufacturer.





Deciding on the right frame with the help of a store associate.



Measuring the distance between the eyes. 3-D head scanning could make this easier and more accurate.

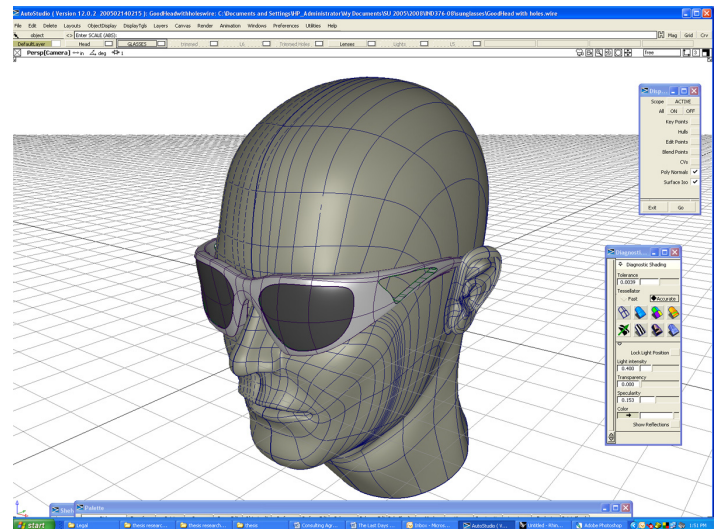
Case Study: Custom Sunglasses

There is truly something special in buying a one of a kind product whether it is custom made pair of jeans or a fully custom motorcycle. The problem typically lies in the premium cost associated with custom goods, placing them out of reach of the average consumer.

Picture this, you go your local shopping center for a pair of sunglasses. You walk into the store where you meet with own personal store representative, this person asks you a few questions about the type of shades you are looking to purchase, the types of activities you might use them with, color preferences etc. They next use a device to scan your head and produce a 3-D image map of it. The image map is loaded into the system and a technician creates a virtual 3-D model of the product you are interested in and adjusts it for optimal fit. One of your ears is $\frac{1}{2}$ cm higher on one side of you head? No problem, the software compensates for this. The 3-D file is then used to create a one of a kind custom fit pair of sunglasses through an advanced fused deposition modeler. You continue shopping for about an hour and return to find your one of a kind eyewear.



Face generating software use photos to generate a 3-D model.



Student at work on sunglass design.

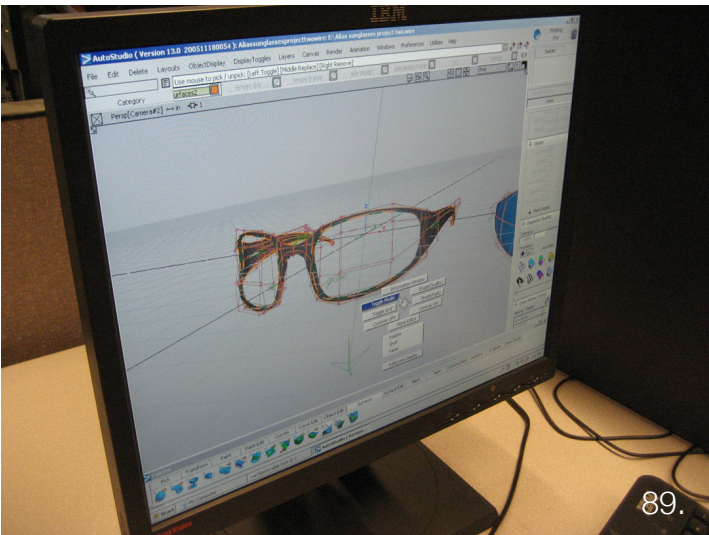
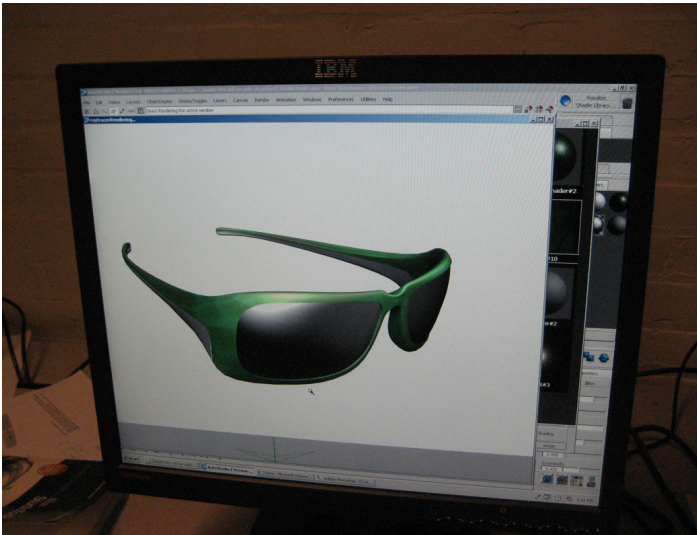




Students wearing their designs.

This is not that far fetched and it was the premise for a recent project involving students in my third year 3-D modeling class. The goal was for the students to design the perfect pair of sunglasses for perhaps the hardest client you could imagine, themselves. Front, top, side view photos were used as a guide to modify human head geometry to generate a perfect fit. Students used Autocad's Alias Studio to create sunglasses based on their personal preferences. The designs were then printed on the Design Department's FDM printer to test fit. Revisions were made and new versions were built. The project was a great success and some students have actually finished their glasses by hand and are trying to find ways to take it to the next level by adding lens and engineering features.

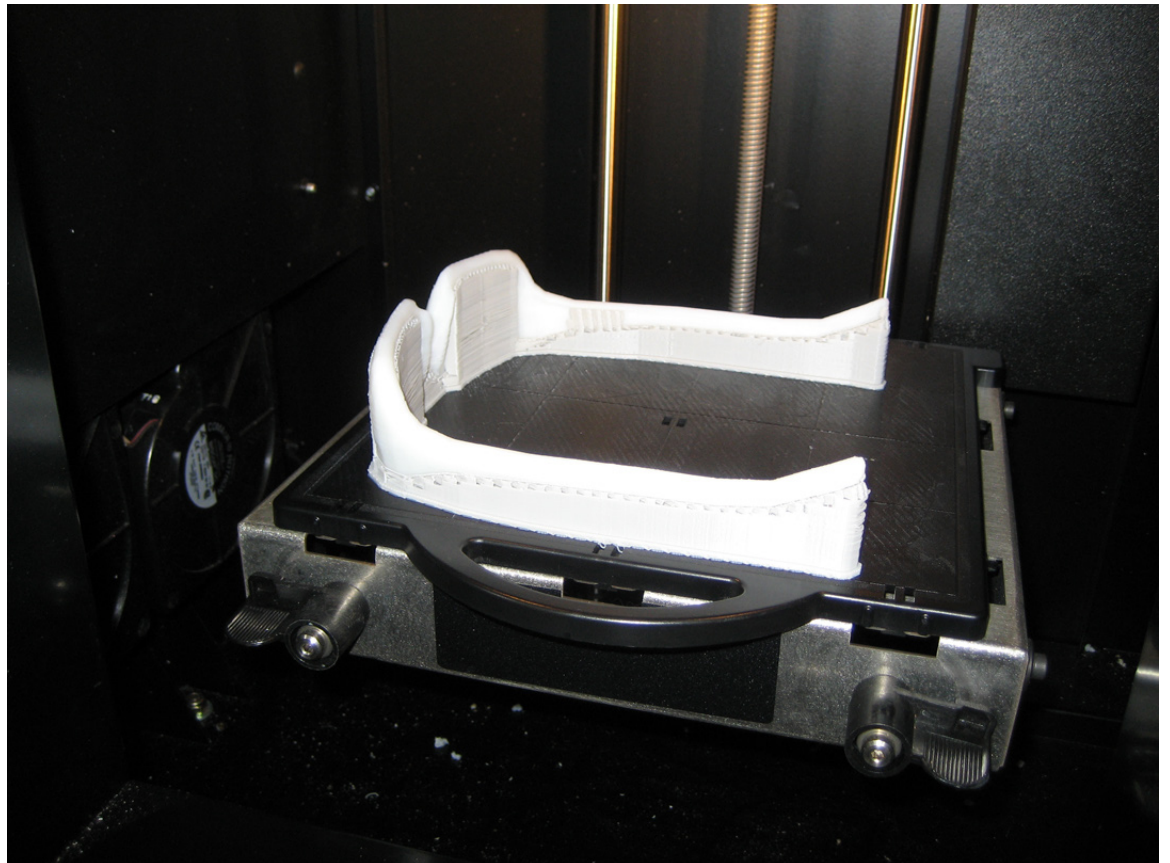
On screen view of 3-D model.



Sunglass model created on FDM machine.

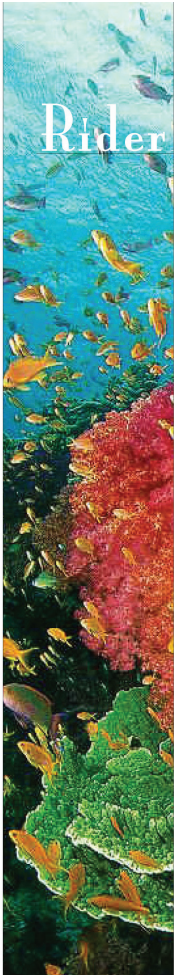


FDM part ready to be removed.





Third year industrial design student Jeff Gerlach wears the frames illustrated below. Jeff hand finished the frames soon after they were pulled from the machine.



Rider Sunglasses

Jeff Gerlach





a kornas

Concept renderings of student work.

Conclusion

“Between the 80’s and early 90’s, design became a tool for commercial marketing...now we think it should be used to create a desirable environment and that greater emphasis should be placed on ‘individuality’ in the future. People will have more choice as quick communication and fast transportation make a wider range of designs from across the world accessible to them...personal attachment will become a more important factor in design.” –Shin + Tomoko Azumi (quoted in Fiell 53)

Legislation drafted in an effort to open more foreign markets to U.S. made goods is flawed in many ways. Designing products for another culture without being immersed in that culture is a nearly impossible endeavor. American branded goods are still very much sought after and often copied in many parts of the world. This could be attributed more to availability of these products than actual demand. Localized manufacturing can work for the collective good of the entire world, not just America.

Labor problems are beginning to percolate in places like Thailand where 400 labor strikes occurred in 2007. As inflation rises in third world countries like Thailand, it becomes more difficult for workers to live off their earnings. A typical Nike shoe retails for \$80, 25 percent of which goes to the manufacturer and a small fraction of that goes into the workers pocket. Once workers in Southeast Asia demand more of the rights they deserve will companies then move operations to other areas of the world. Are we going to exploit the workers of Africa next?

The price of oil reached an all time high of \$120 per barrel in May 2008 and OPEC predicts that the price could rise to \$200 in the not so distant future. We are actually squeezing oil from the ground in some parts of the world. It is estimated that we have burned through more than half of all the oil left in the world. The limited supply and rising demand will push oil prices to even higher levels.

The sharp increase in fuel costs has now affected food prices causing shortages and riots in many parts of the world. Many countries are insisting that they need farm subsidies to keep their agricultural bases intact. Bio-fuel production has had an adverse affect on food prices, as more and more corn is being grown for ethanol. This is forcing wheat prices to skyrocket. We are in the midst of a major global energy crisis. This crisis will change the world in profound ways. It is not enough for us to just shift from one energy source to another, we need to think outside of the box on reducing consumption. RM and localized manufacturing can help us do this.

History does seem to be repeating itself. If we only knew then what we know now about the impact of advancing society at the cost of the environment, would we have continued on this self-destructive path? We now know that we can not continue this model, but is it our prerogative to force the rest of the world to change their practices and deny them the same opportunity for advancement that we as the U.S. have already gained? I think that we owe it to the future generations of the world to try.

Why have I focused so much attention on the evolution of craft into manufacturing? I believe it is important to understand how antiquated our American system of manufacturing is. We are working with a 200 year old model and we need to change the game and think differently. The colonial elite pooled their resources to create trusts or companies that provided employment to skilled technical laborers. These laborers became the middle class who in turn was the very consumers that purchased the products developed by the various manufacturers. These early employers not only provided jobs but also subsidized housing. Helping workers with home ownership is a smart investment; it creates the social fabric needed to build communities. Strong communities develop strong education systems, which strengthen the nation as a whole.

So what happened to the system and why has it broken down? There are many factors that led to the decline in American manufacturing. Foreign manufacturing competition and stricter environmental guidelines coupled by a demand for affordable products have created a vacuum that has sucked domestic manufacturing overseas. One might argue that the shrinking of the middle class may be partly to blame or at least a result. The introduction of women to the workforce during and after WWII has led to dual income families who have essentially doubled their income. Middle class is difficult to define but it begins at the poverty line and extends to the national median income. Families with one breadwinner making \$50k per year have progressed to two breadwinners making close to the same salaries. A \$100K gross income family is no longer middle class. We need to devise a plan to pull more low wage earning, under educated service workers into the gap created by dual income families. Technical jobs requiring lower cost vocational training could help combat the effects of the rising cost of post-secondary education. The college education required for most decent paying jobs may soon be completely out of reach of the people in the lowest economic demographic. This will increase the gap between the haves and the have nots. How can advances in technology, namely communication, materials and manufacturing methods reinvigorate the diminishing middle class? I strongly believe that localized manufacturing could be the game breaker necessary to help make this happen.

Could a self-sustaining, 100% green facility relying on wind and solar energy manufacture custom made products locally while eliminating many of the ills associated with the current model of manufacturing overseas? Could localized manufacturing eliminate or greatly reduce the environmental impact and increased cost of packaging, shipping, warehousing and distributing products around the globe? Many companies moved their manufacturing operations overseas because of the lack of environmental controls and availability of cheap unethical labor. These issues are beginning to strongly resonate not only with U.S. consumers but also with consumers the world over. Could a stronger, more educated middle class fueled by skilled, technical workers be commercially viable for companies to consider localized manufacturing? I believe so. Is a weakened U.S. dollar an

incentive for foreign investment in American manufacturing with its educated, technically oriented, ethically sound and environmental conscious workforce? I think it's a strong possibility.

In 2007 Nike produced over 300 limited edition shoes, further support of the shift from a mass based system to a micro based system.

In the future, consumers will have even more access to the product development process. Micro niche markets will dominate the consumer landscape. Retail environments will still exist but will be based more on the experience created by consumer participation in the RM process. Stores will become miniature factories where more advance products are produced and assembled in front of our eyes.

User participation will create a new sense of ownership and emotional attachment in the products that people use, encouraging them to keep products longer, and improve them verses replace them. Many less advanced products in the future will be printed at home on personal fabricators using data downloaded from the Internet. Think iTunes for products. This will eliminate many of the ills associated with the current logistics model. Less energy will be consumed, less waste created. Packaging will no longer be needed for many of the goods that we consume as products can go from fabricator directly to end-use. Products will be easier to fix because updates to their architecture will be downloaded instantly like software updates are now.

Design's role in the future will evolve in new ways. User participation will need to be guided in some way or we will end up with a world filled with ugly products with limited regard to functionality. Commodity products will most likely be outsourced to designers in other areas of the world. Smaller market segments will demand specialized expertise in custom solutions for individuals. Smaller design firms will use a network of specialists that will be hand picked to cater to the needs of specific projects. Professor Francesco Nerici of Syracuse University's London Program gives this analogy: *Imagine design as you would the movie industry. In the early days of film you had a single studio, which had a stable of actors, directors and producers under contract. Now movies are made entirely different, specialists will be waiting for the perfect fit. Design is beginning and will continue to follow in a similar model.*

RM can be the solution to many of the problems we are facing today. RM is the future for the way products will be developed and distributed to consumers. Consumers are demanding more participation in the world around them and more specifically the product development world. Companies spend billions of dollars a year trying to pinpoint exactly what consumers want through surveys, research studies, focus groups and conjoint analysis. Designers have traditionally been the advocate for the user and have pushed for features, functionality and aesthetics that resonate with groups of individuals. Designers will continue to work for the user but in a new capacity. Designers will be charged with creating new ways to get the right feature sets to individual consumers. The best way to define these attributes is by allowing the user to be an integral part of the design process. The "push" system of delivering products will be replaced with a "pull" system. Advances in communication and technology are already allowing this to happen. For instance consumers can build the features-sets they want in products like automobiles in ways never imagined. Through internet portals they can select every available option, see the final product previewed in front of their eyes and in some cases can even watch the product being built in the factory.

RM is the next logical step in the evolution of manufacturing. It will allow users to have a direct link to the process and the end product. Anecdotal research done as part of this project suggested that people who have a say in the design process tend to keep their products longer, repair them versus replace them and have an unbreakable emotional tie to the artifact (see appendix A). Designers will work to create products and retail environments that enhance the user participation experience.

We are living in a society of instant gratification. The Internet provides 24 hour access to products around the world. Consumers no longer have to wait until a brick and mortar store opens to buy the things they want and need, it's done instantly through the web. However they do have to wait for the order to be processed and shipped, which can take up to several weeks depending on the product. The shipping costs are almost always an additional expense tacked on to the order. This expense can be a significant cost adder to order depending on how quickly a consumer wants the product. RM would allow products to get to consumers faster because they would be made locally. Users could order products through the web and they could be picked up at the local RM location. Consumers already have the option of ordering products and having them shipped directly to the store for pickup, this would just take it one step further.

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