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Spectacle, Symbol, Strain, and Showpiece: Americans and Technology in the 1930s

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Abstract

In 1928, American voters elected Herbert Hoover to the presidency, giddy with his confident assertion that upcoming years would bring continued increases in national prosperity. Herbert Hoover, who trained as an engineer at Stanford University and made a fortune in the mining business, embodied the faith that many observers of the 1920s placed in America's new machine age. Indeed, as secretary of commerce in the early 1920s, Hoover had personally promoted the expansion of commercial aviation, development of radio, and even experiments with television.

Disciplines

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Spectacle, Symbol, Strain, and Showpiece: American Technology in the 1930s

10

Amy Sue Bix

Technology Takes Hold

In 1928, American voters elected Herbert Hoover to the presidency, giddy with his confident assertion that upcoming years would bring continued increases in national prosperity. Herbert Hoover, who trained as an engineer at Stanford University and made a fortune in the mining business, embodied the faith that many observers of the 1920s placed in America's new machine age. Indeed, as secretary of commerce in the early 1920s, Hoover had personally promoted the expansion of commercial aviation, development of radio, and even experiments with television.

For Americans of the roaring twenties, especially middle-class consumers, modern technology seemed to be the ultimate guarantee of national prosperity. Manufacturing output practically doubled during that decade. More middle-class families were able to acquire (often on credit) automobiles with annual model changes, radios, new kitchen equipment, and other exciting products. Major firms, such as AT&T, General Electric, and DuPont, had established corporate research laboratories, harnessing chemistry and engineering innovation to bring to market new plastics, appliances, and consumer services. Thanks to the efficiencies of assembly-line development, supply-chain integration, and other mass production techniques, Henry Ford was making 1.5 million cars a year in the 1920s. Americans could buy a Model T for less than \$300.

Yet behind headlines touting the soaring stock market, signs of trouble loomed. Slowdowns in consumer spending and construction led to excess manufacturers' inventories, threatening layoffs and a downward spiral of economic trends. The great crash of 1929 shook up easy rhetoric about modern science and technology ensuring national wealth. Over subsequent months, industry and construction slowed, banks closed, and farmers blockaded roads to protest low crop prices. National unemployment

rose above 25 percent, and some cities experienced even worse difficulty. Detroit's economy imploded, as vehicle production plunged from more than 5 million in 1929 to just over 1 million in 1931. The world's biggest factory, Henry Ford's 11,000-acre River Rouge plant, laid off 75 percent of its workforce, leaving large numbers of families without any support and facing eviction. In March 1932, labor organizers led an estimated 3,000 autoworkers and their families in a "Ford Hunger March" to protest layoffs and demand union recognition. Ford's private security force and local police attempted to block this protest with tear gas and fire hoses, then opened fire on the crowd, killing five.

Desperately seeking to explain the Great Depression, some Americans began to question the gospel of machine age progress. Critics suggested that rather than guaranteeing the growth of prosperity, rapid technological change might have contributed to economic disaster as industrial mechanization led to the elimination of jobs.

Yet even as middle-class Americans read newspaper stories and heard lectures about the threat of technological unemployment, people also witnessed continued technological milestones. Despite the Depression, construction of bridges, dams, and record-setting skyscrapers continued, symbolizing man's triumph over nature. Pilots thrilled onlookers by breaking aviation records, while the development of new airplanes promised the conquest of geographic limitations.

More than that, President Franklin Delano Roosevelt's New Deal relied on technological development as a tool to revive the country's economy and a symbol for progress. His plans for rural electrification, hydroelectric power, and infrastructure building promised to transform entire regions, opening up opportunities for poorer or isolated Americans to share the comforts of new consumer technologies. While economic disaster forced families to cut back spending on luxuries, many considered cars, radio, and movies to be modern necessities, providing both reassurance and escapism. New technology in the form of streamlined trains and nylon stockings generated widespread excitement and represented the hope of continued technological progress. Exhibits at the New York World's Fair of 1939 made this promise tangible, that over the long run, science, engineering and business working together would pull the United States out of Depression and ensure its consumers the world's best standard of living.

Technology as Spectacle: Engineering Megaprojects and Aviation

The sheer size of Depression-era construction megaprojects and continued technical developments in aviation commanded people's attention. Although many building plans had originated back in the 1920s before the Depression hit, their spectacular completion symbolized the hope of restoring American greatness. Technical innovations in large-scale concrete work and materials handling facilitated construction, while population growth, especially in the West, prompted concern for infrastructure development.

Thousands of unemployed American workers rushed to the big engineering projects to seize the job opportunities they offered. Erector™ Sets, toy construction kits complete with metal beams and small gears, were a popular toy for boys, who could dream about becoming grown-up civil and mechanical engineers designing skyscrapers, dams, bridges, and railways.

Among this era's most exciting engineering projects was Boulder Dam (later renamed Hoover Dam). The construction, begun in 1931, formed a massive reservoir out of rough desert and set the stage for continued development to reshape the land and economy of the American West. Especially across southern California, this modern engineering transformed inhospitable territory into new residential environments, industrial opportunity, and valuable agribusiness. One of the most dramatic technical challenges arose right from the start, as builders proceeded to divert the powerful Colorado River. Crews raced each other as they drilled and dynamited four tunnels, fifty feet in diameter, into the canyon wall, and then constructed a giant cofferdam out of tons of rock to redirect the entire river. Before starting the dam itself, workers had to dig away centuries-old sediment to reach bedrock, while building major networks of rail lines, cables, and pulleys to carry heavy material to the site.

With up to 5,000 men on the project, simply providing temporary housing posed logistical nightmares, as did supplying the mess hall where workers consumed twelve tons of vegetables and fruit, five tons of meat, and more than two tons of eggs each week. Dehydration, electrocution, carbon-monoxide poisoning, and falls posed constant threats, as did the blistering summer heat. More than 100 men were killed and hundreds more seriously injured. "High-scalers" undaunted by heights (supposedly including former circus acrobats and sailors, along with many Native Americans) dangled along canyon walls to clear debris.

The dam's scale, more than 700 feet tall, raised further complications; calculations showed that the vast heap of concrete would take over a century to cool naturally, and resulting stresses would risk cracking the dam. Accordingly, engineers devised an ingenious system of integrating pipe coils into dam blocks that could run cold water through the structure. The entire project, including powerhouses, intake towers, and overflow spillways, was finished under budget and in less than five years, two years ahead of schedule. Tourists poured in to see what became upon completion the world's tallest dam and the world's largest hydroelectric facility, supplying electricity to seven states. Hard labor and powerful engineering had overcome heat, danger, and technical challenges to reshape nature to human needs, continuing America's conquest of the Western frontier.

Another structural icon created during the 1930s was San Francisco's Golden Gate Bridge. Many engineers had long insisted such a structure would be impossible to build for anything less than \$100 million. Bridge designer Joseph Strauss promised an affordable construction and began aggressively promoting his vision to local politicians, along with cannily distributed bribes. Civic leaders realized that with the city blocked on three sides by water, future geographic expansion depended on securing better automobile access to open areas on the north. The already-overcrowded

ferry system could not handle more traffic, though owners whipped up an intense but futile campaign to block bridge plans. Lured by the promise of jobs amid headlines about the growing Depression, Bay Area voters in 1930 overwhelmingly agreed to a \$35 million bond issue, pledging their counties' property and individual homes, ranches, and businesses as collateral.

After reassurances that construction would not hamper civilian shipping or military harbor operations, the U.S. War Department, which owned land on either side of the strait, gave the go-ahead. Excavators moved more than 3 million cubic feet of dirt and stone in 1933 before pouring the massive concrete anchorages. Divers fought tricky currents to lay blast charges for the southern tower's base, working blindly in murky ocean and risking "the bends" from decompressing too fast under the tight work schedule. While Strauss initially proposed an awkward cross between a suspension and cantilever structure, designers ultimately dared build what became the world's longest main suspension span, 4,200 feet between the two towers. The bridge was calculated to flex and sway as much as twenty-seven feet in strong Pacific gales. The 7,659-foot-long cables would absorb the brutal wind stress, each more than three feet in diameter, the biggest ever made. Technological innovations speeded up the onsite spinning of the cables; each bundled together more than 27,000 individual strands, enough wire to circle the equator three times. Bridge architects gave the structure a distinctiveness to match the dramatic setting, with its elegant Art Deco style and vibrant "international orange" paint. The bay's freezing fog and sixty-mile-per-hour wind gusts made the slippery metal catwalks and girders incredibly treacherous for the high-steel workers. Conventional expectations projected that for each million dollars spent on a major bridge, one death would occur. Strauss insisted that workers don an early version of the modern hardhat and use safety lines, while spending more than \$130,000 to sling a safety net beneath the entire span. This net caught nineteen men who otherwise would have fallen to their death, survivors subsequently nicknamed the "Halfway to Hell Club." Showboating workers had to be dissuaded from jumping into the net for thrills. The admirable safety record of months without a single fatality was shattered when an unsafe scaffold collapsed and tore the net loose, killing ten workers.

Following more than four years of construction (but ahead of schedule and under budget), the Golden Gate Bridge opened in May 1937. On the first day, reserved for pedestrian traffic, approximately 200,000 people came to walk (or run, roller-skate, and even tap-dance) across the city's new icon and enjoy the spectacular view from its road. Five hundred airplanes flew over the bridge; the battleship *Pennsylvania* led a fleet sailing under the bridge, while the city celebrated with spectacular fireworks, parades, and a pageant titled, "The Span of Gold." Counties on the north side immediately began marketing redwood forests and other natural attractions to visitors.

On the East Coast, the Depression failed to halt New York City skyscraper-builders' race for record height. In May 1930, the seventy-seven-story Chrysler Building became the first to pass the 1,000-foot mark.

Wanting a bold architectural statement representing the essence of modernity, Walter Chrysler gave his new headquarters a dramatic Art Deco crown. Gargoyles resembled Chrysler hood ornaments; other building decorations were modeled after car radiator caps, while the finial was covered in a new form of steel that gleamed in the sunlight. After announcing the intended height, the architect ensured that his building would top its competitor, the Bank of Manhattan, by secretly altering his plans to add a 180-foot-tall spire. That needle was dramatically hoisted into position from inside the spire in just ninety minutes at the end of construction, making the Chrysler the world's tallest building—for less than a year.

When President Herbert Hoover threw a ceremonial switch in Washington, D.C., on May 1, 1931 to officially open and light up the new Empire State Building, that 102-story tower took the title of the world's tallest building. Construction had finished in just thirteen months, sometimes as fast as one story per day, and under budget at \$25 million. In the Depression-era labor market when other projects had ground to a standstill, foremen had their pick of the city's best ironworkers, stonemasons, carpenters, plasterers, brick workers, concrete workers, and electricians, almost 3,500 workmen who were grateful to earn almost \$2 an hour. Trucks hauling more than 50,000 tons of structural steel practically still hot from Pennsylvania mills, plus Italian marble, Indiana limestone, and granite, drove right into the building's basement. Their loads were immediately hoisted onto small temporary railroads, specially built on each floor, which carried materials directly to workers.

Lewis Hine, whose well-muscled blue-collar heroes concentrated fearlessly on their expert work, immortalized the drama of skyscraper construction in photographs. A classic Hine photo titled "Icarus" showed one of these "sky boys" suspended gracefully on midair cables, trusting in experience and balance rather than on safety harnesses or other protective equipment (one dozen men were killed on the project). The tower was capped with a steel and glass mooring-mast for dirigibles, but strong winds and lack of room eliminated any prospect of having airships dock there regularly. Making the building usable required sixty-seven elevators, traveling up to 1,000 feet per minute, plus a giant water-pumping system with tanks every twenty floors. Upon completion, thousands of visitors each day flocked to its observation decks, but the Depression put a damper on office rentals, generating the nickname of the "Empty State Building." Still, the building instantly became a symbol of New York and, by extension, American greatness, featured in the dramatic climax of the original *King Kong* movie (1933). Writer E. B. White later commented that the Empire State "managed to reach the highest point in the sky at the lowest moment of the Depression" and "shot 1,250 feet into the air when it was madness to put out as much as six inches of new growth" (*New York Times*, April 23, 2006). After destruction of the World Trade Center on September 11, 2001, the Empire State Building again became New York City's tallest building.

Americans who flocked to watch the Hoover Dam being built, gawk at the rising Empire State Building, or walk across the Golden Gate Bridge



Lewis Hine's photograph, *Icarus*, showing a worker fastening steel cable to hold a derrick in place prior to lifting steel girders and other steel parts at the top of the Empire State Building. (Bettmann/Corbis)

also remained fascinated by aviation. The Wright brothers' pioneering experiments at Kitty Hawk, North Carolina, in 1903 had inspired rapid development of airplane engineering and flight skill in both the United States and Europe, leading up to the dog fighting and aerial reconnaissance of World War I. The postwar surplus of affordable planes encouraged enthusiasts to learn to fly, while thousands visited air shows to gasp and scream at the rolls, dives, and other stunts performed by barnstormers. Government support for airmail, airports, and nighttime flying encouraged improvement of aviation, as did federally funded research on airplane engineering. Nevertheless, through most of the 1920s, U.S. passenger air service remained irregular; widely publicized accidents meant most people remained more comfortable traveling by train.

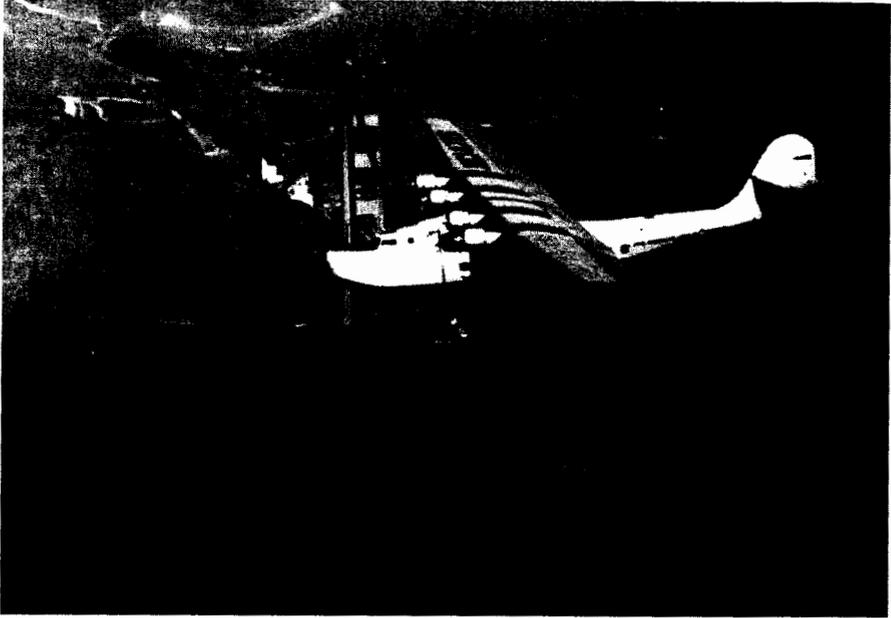
Despite the Depression, the 1930s became a golden age of American aviation, a time of significant advances in airplane technology and business. Perfection of all-metal, single-wing designs symbolized modernization, replacing the World War I era wood and fabric construction that proved inadequate for commercial airline growth. Famous Notre Dame football coach Knute Rockne was among the passengers killed in a 1931 TWA crash; investigations showed that the wooden structure of the widely used Fokker Trimotor was prone to delamination, that is, midair wing

separation. Poor design also meant that drag prevented older planes from reaching more than 100 miles per hour. For profitability, airlines required a faster plane that would provide pleasant passenger service.

In 1936, Douglas Aircraft introduced the all-metal monoplane DC-3, one of the most significant and successful airplanes in history. Known as the first modern airliner, the DC-3 dominated the commercial aviation market within just six years and supported airline growth around the world. Thanks to easy maintenance and aerodynamic innovations that engineers said almost let the plane fly itself, the DC-3 made passenger routes profitable. Its impressive safety record accelerated public acceptance of air travel, while its ceiling of more than 20,000 feet let pilots rise above bad weather. With soundproofing, passengers could even hold conversations without shouting, impossible in earlier planes. A sleeper model held luxurious berths for fourteen passengers, allowing American Airlines to offer a seventeen-hour Newark-to-Los Angeles service, substantially speeding up transcontinental routes that previously took more than twenty-four hours. United introduced the first stewardesses, required to be under twenty-five, single, and registered nurses, who could tend to airsick or nervous passengers. Almost 11,000 civilian and military versions of the DC-3 were manufactured, and hundreds were still flying in the year 2000, for both passenger and cargo service.

But the real glamour of 1930s aviation came from Pan American Airlines (Pan Am), whose "China Clippers" carried mail and passengers more than 8,000 miles between the U.S. mainland and Hawaii or the Philippines. Before opening these new routes, Pan Am had to build new long-distance communication systems, set up radio towers, and develop direction-finding navigation systems with greater range. Pan Am built and expanded remote bases on Midway and other Pacific islands, dynamiting lagoons and chopping down jungles to clear areas for refueling and to build hotels for passenger stopovers. The biggest Pan Am "flying boats" could carry up to seventy-four passengers or provide overnight sleeper service for thirty-six. At a round-trip cost of almost \$1,500, passengers received luxury treatment meant to match the extravagance of the finest ocean liners, with armchairs and full dinners served on good china. Crossing the Pacific by steamship required three weeks, while Clipper service from San Francisco to the Philippines took just sixty hours, stretched over seven days. Glamorous advertisements showed well-dressed passengers disembarking under Hawaiian palm trees, welcomed by beautiful native girls offering leis. Though such extravagance was almost unimaginable for Depression-era middle-class Americans, transoceanic Clipper service symbolized romantic adventure as well as the new global reach of technology.

Other observers in the early 1930s thought that the future success of long-distance passenger service would depend on lighter-than-air vessels. Germany led the world in developing airship technology, stemming from its World War I use of dirigibles; its *Graf Zeppelin* made a round-the-world flight in 1929. To prove the Reich's technical and political superiority, the Nazi government proceeded to build the largest rigid airship ever.



Philippine Clipper in flight over the Golden Gate Bridge, 1936. Pan American Airlines had three M-130's in the 1930s: the *China Clipper*, *Philippine Clipper*, and the *Hawaii Clipper*. (Library of Congress)

Emblazoned with swastikas, the *Hindenburg* made a spectacular appearance at the 1936 Berlin Olympic Games. Crowds gathered to watch the *Hindenburg* take off for its ten successful transatlantic Europe-U.S. flights the first year, at a time when no such commercial airplane service was available. Even amid the Depression, the *Hindenburg* sold virtually every seat; its round-trip price of \$720 and speeds over eighty miles an hour were faster and less costly than ocean liners. Passengers enjoyed luxurious cabins as well as a fancy dining room, library, lounge (complete with a lightweight aluminum baby-grand piano) and even a specially protected smoking room.

On May 6, 1937, after arriving from Germany on that season's first transatlantic flight, the *Hindenburg* burst into flame and crashed within seconds. A radio announcer watching passengers and crew jumping to escape screamed into his microphone, "Oh, the humanity!" (Van Riper 2003, 119). Sixty-two out of ninety-seven passengers and crew actually survived (with one member of the ground crew killed). Immediately, ongoing controversy arose over the cause; conspiracy theorists suggested sabotage aimed at embarrassing Hitler's regime, while others speculated that lightning or static electricity from nearby storms had ignited the more than 7 million cubic feet of hydrogen. Later investigations linked the disaster to the highly flammable nature of the *Hindenburg's* skin covering. The shocking accident, combined with spreading military aggression that diverted government attention, ended optimistic hopes for extensive commercial lighter-than-air passenger transport.

During this era, aviation heroes continued to grab headlines, and the danger of flying only added to its intrigue. Pilots pushed the limits in aiming to break records; several died in attempts to cross the Atlantic Ocean in nonstop flights. On May 21, 1927, airmail pilot Charles Lindbergh captured world adoration after completing the first solo nonstop airplane flight between Europe and North America, reaching Paris thirty-three hours after leaving New York in his *Spirit of St Louis*.

Almost from the beginning of aviation, a handful of women had mastered the new technology, defying conventional gender expectations and frequently garnering the scorn of male pilots. While the daring of all aviation celebrities elicited awe, women flyers carried an extra curiosity value and air of glamour. Among the most famous female pilots was Amelia Earhart, a tomboy fascinated by air shows who acquired her pilot's license in 1921. In 1932, marking the fifth anniversary of "Lucky Lindy's" flight, Earhart overcame mechanical difficulties and icy winds to cross from Newfoundland to Ireland in just under fifteen hours. As the first woman to fly solo across the Atlantic, Earhart displayed immense courage and aviation sense in the days when long-distance flying remained incredibly risky. She was immediately nicknamed "Lady Lindy," and Congress rewarded Earhart with the Distinguished Flying Cross, the first time that award was presented to a woman. Just three months later, Earhart became the first woman to fly solo nonstop from one U.S. coast to the other, then broke her own record time with a second cross-country flight the following year. Earhart worked to popularize aviation, publishing books about her flights, going on national speaking tours, and serving as aviation editor for *Cosmopolitan* magazine, even writing articles promoting the excitement of flying for women.

In 1935, Earhart became the first aviator, male or female, to solo the 2,400 miles from Hawaii to the U.S. mainland, yet already had in sight an even more ambitious goal. While previous pilots had completed round-the-world flights, Earhart aimed for the longest distance, at the equator. Heading east from Miami in June 1937, Earhart and navigator Fred Noonan successfully covered more than 22,000 miles, roughly two-thirds of the journey. On July 2, the pair headed out of New Guinea on the most difficult leg, with the navigational challenge of trying to locate tiny Howland Island after crossing 2,500 miles of empty Pacific Ocean. Assistants in a waiting Coast Guard cutter listened helplessly to Earhart's final radio messages declaring that her fuel was running low. The tragedy captured international headlines, as did the ensuing futile search. Almost immediately, rumors spread that Earhart's flight had been cover for a secret American spy mission against the Japanese, who then shot down and captured her. Speculations surrounding Earhart's mysterious disappearance have continued to multiply over the years. Intriguing clues (including discovery of a woman's shoe and airplane parts similar to those of Earhart's Lockheed Electra) may suggest a crash landing on a nearby island, but no definitive proof has emerged. The drama of 1930s aviation, even its apparent accidents and failures, only underlined the significance of conquering the skies.

Technology as Symbol: New Deal Transformation and Machine Age Beauty

With Roosevelt's inauguration speech declaring that "the only thing we have to fear is fear itself" (Black 2003, 270), the president started a whirlwind of activity that committed the federal government to dealing directly with Depression problems. Among the resulting "alphabet soup" of New Deal agencies, the Civilian Conservation Corps, the Public Works Administration, and the Work Progress Administration supported major construction projects around the country. Millions of jobless men earned paychecks by building roads, parks, airports, schools, telephone lines, and New York City's Lincoln Tunnel, which today remains the world's busiest vehicle tunnel. Such infrastructure development was just one way that Roosevelt's administration embraced technology as a tool for initiating major social and economic changes.

President Roosevelt was particularly interested in leveling inequalities faced by rural families by using technology to improve farm work, modernize backward homes, spur industrial development, and correct environmental problems. Eager social science experts in the new administration felt confident that by combining skilled government planning with large-scale engineering, they could transform entire regions. In 1933, Roosevelt set up the ambitious Tennessee Valley Authority (TVA) project, aimed at alleviating poverty and improving lives across seven states by building an integrated system of dams and hydroelectric plants along the Tennessee River. The undertaking aimed to solve many of the area's problems simultaneously, controlling devastating floods, improving navigation, and providing employment. Idealistic project managers hoped that by generating massive amounts of cheap power, TVA would bring the benefits of modernization to thousands of rural residents who never had electricity before and also stimulate regional industrial development. While private power companies protested against this government-sponsored competition, the courts upheld TVA's legality. Engineers tackled the challenges of designing Norris Dam and the TVA's other enormous water-control projects, while planners built (white-only) model communities nearby to house workers, complete with schools and hospitals. Agriculture experts set up demonstration farms to promote fertilizer use and reforestation to help residents salvage eroded and depleted soil, while health workers distributed vaccinations against smallpox and typhoid.

With creation of the Rural Electrification Administration (REA), Roosevelt expanded this principle of using technology as an economic and social catalyst to reshape an even larger area of the country. By the early 1930s, electric light and power were available to most city residents (outside the poorest neighborhoods), but to only about 10 percent of rural Americans. Country dwellers appeared increasingly out of touch with modern technological life, experts warned, enticing young people to leave family farms. Promoters promised that electrification would raise both living standards and profits for farmers. State fair exhibits touted the wonders

of electric threshing machines, butter churns, and wood splitters. Agricultural experiment stations published evidence that hens surrounded by electric light laid more eggs, while cows drinking continuously pumped fresh water produced more milk. Although a few farmers installed windmills or dammed streams to generate their own electricity, private utilities judged it prohibitively expensive to extend distribution lines to remote areas with low population density. In 1935, New Deal government stepped in to remedy that situation, constructing almost 75,000 miles of electric lines in just two years and helping to establish more than 400 electric cooperatives. Within five years, one-quarter of rural households had been electrified, along with rural stores, churches, and schools. REA agents offered farmers government loans for buying electric corn huskers to speed up harvesting, electric stoves to ease housework, and radios to bring news and entertainment into isolated homes. REA publicity contrasted photos of a woman using her new electric washing machine to pictures of her with an old-fashioned hand wringer. Such images underlined the optimistic message that technology could give rural Americans all the modern consumer lifestyle benefits already enjoyed by their urban counterparts.

Prominent Depression-era artists conveyed admiration for the sheer power and beauty of electricity and other technology in their work. In 1932, Mexican Marxist painter Diego Rivera came to the Detroit Institute of Arts to paint a large mural (commissioned by Henry Ford's son Edsel) to comment on the relationship between humans and modern technology. Rivera, who had been fascinated by machinery as a child, spent weeks studying and sketching Ford's world-famous River Rouge plant and its equipment, along with workers' faces, homes, and neighborhoods. The "Detroit Industry" frescos revealed Rivera's admiration for American industrial might. His detailed depictions conveyed the harmonious design and impressive capacity of steam turbines, stamping presses, and blast furnaces. Rivera painted Ford's multiracial workforce making molds for engine blocks, stacking them on conveyor belts, and pouring molten metal, muscle, and machinery that combined harmoniously in valuable productivity. As a socialist, Rivera admired engineers and prized technology's potential to create a better world. But other parts of his twenty-seven-panel mural showed modern science and technology as dualities of creation and devastation, contrasting the horrors wrought by chemical weapons and warplanes to the benefits brought by vaccination and innovative passenger aircraft.

Charles Sheeler spent much of the 1930s trying to capture the visual appeal of modern machinery and industrial architecture. Back in 1927, the Ford Motor Company hired Sheeler to photograph River Rouge for a promotional campaign, and he produced dramatic images of how the giant complex transformed coal, lumber, iron ore, and other material into a steady stream of finished product. Sheeler's photos made conveyor belts look as graceful as cathedral arches, with a modern rhythmic geometry. Sheeler turned a number of his photographs into paintings that he called part of a new American art movement, Precisionism. While earlier artists painted the splendor of waterfalls, fields, and other natural features,

It would appear that there was still a chance for the amateur or hobbyist inventor to invent, even in the age of the Great Depression, when it seemed that large-scale industry and "big" technology had precluded such possibilities. Thus, in November 1930, two young New York musicians, Leopold Mannes and Leo Godowsky, Jr., sold their processes of color photography to the Eastman Kodak Company in Rochester, New York. Leopold and Leo, both thirty years old, were the sons of famous New York musicians, the one a conductor and violinist, the other a pianist and composer.

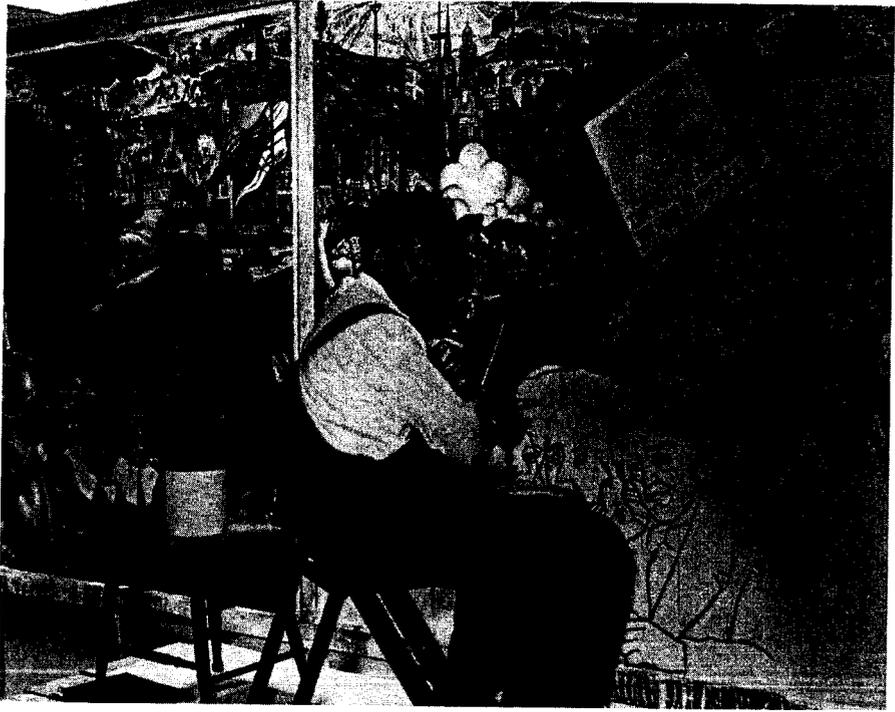
Both Leopold Mannes and Leo Godowsky worked on developing a simple process for making color photographs as handily as black and white ones. They met when they were fifteen years old. They soon understood they were trying the same techniques. Hence, they combined efforts, even as they studied to be musicians, and established a laboratory as partners in 1920 in New York City. At that time, both had graduated from college, Leopold Mannes from Harvard in

physics, and Leopold Godowsky from the University of California, and each continued to pursue a musical career while also maintaining a scientific and technological partnership with the other to develop their desired simple process for making color photographs. In this work, they were self-taught, mainly through reading and in their experiments in their laboratory. What started as an adolescent hobby had grown into a full business and technological partnership. The arrangement they made with Eastman Kodak provided that they sold their research to the company but would continue to work on their process as Kodak employees, initially in their laboratory, eventually in Rochester. In the meanwhile, they continued their careers as members of New York City's musical genre. Leopold Godowsky, for example, had just married Frances Gershwin, daughter of Mr. and Mrs. I. B. Gershwin of New York City, and a sister of the composer George Gershwin.

SOURCE: *New York Times*, November 6, 1930.

Precisionists treated the twentieth-century's manmade and urban environment as equally attractive and important. Artists such as Sheeler and George Demuth concentrated on depicting material objects such as water towers, gasoline pumps, ocean liners, or elevated trains, making function attractive with sharp detail. Many Precisionist images contained no human presence at all, while others showed a few scattered people as machine tenders, their minimal appearance serving to emphasize the grand scale of industry. In 1938, commissioned by *Fortune Magazine*, Sheeler began six paintings of steam turbines, hydroelectric machinery, dams, and other technology to glorify the theme of "power." Similarly, for the first issue of *Life* in 1936, editors chose a cover photo by Margaret Bourke-White showing the Fort Peck Dam under construction, its imposing walls looming like castle ramparts.

During the 1930s, manufacturers worked to make technology even more attractive. In previous decades, industrial engineers had introduced scientific management principles and efficiency goals to optimize production rates. Depression-era businesses hoped to stimulate buying through what might be called consumption engineering. To differentiate their products from competitors and provoke consumer interest, the new field of



Diego Rivera seated in front of a mural depicting American "class struggle," 1933. (*Library of Congress*)

industrial design focused on style, giving objects a modern look. This psychology created a Depression-era craze for streamlining, the rounded corners, smooth surfaces, and sweeping horizontal lines inspired by the sleek Douglas DC-3.

Railroads exemplified the era's obsession with streamlining, competing with each other to promote the most modern-looking designs. The most famous was the 1934 Burlington Zephyr, which had articulated joints between its stainless-steel cars to make the train (soon nicknamed "the silver streak") resemble an unbroken bolt of lightning. Wherever the Zephyr went, crowds gathered along rail lines to watch it break old speed records. Ridership rose, as advertising urged people to "see America streamlined" and promoted railroads' "fleet of modernism" (Porter 2002, 58). For passenger comfort, in contrast to the nineteenth century's ornately decorated Pullman cars, the Zephyr had sophisticated furniture, air-conditioning, and radio music. In contrast to the old images of coal-fired locomotives as disgustingly dirty, the streamliners were clean symbols of the twentieth century, compared to wingless airplanes on tracks.

Yet Detroit engineers discovered that it was possible to stretch the streamlining fad too far. Designers began to take aerodynamic testing seriously and after wind-tunnel testing, decided to give the 1934 Chrysler Airflow a curved roof, a broad flat nose, and headlights integrated into the hood. This dramatic switch from the boxy cars of just several years before

proved too radical. Advertisements pictured the Airflow alongside the era's gorgeous streamlined trains, and resulting excitement stimulated a record number of initial orders. But the Airflow's unusual design, with a specially engineered new suspension system promising a smoother ride, proved difficult and expensive to manufacture. The first to reach market acquired a bad reputation owing to serious production defects, and Chrysler culture shifted back to a conservative style.

Technology as Strain: Labor Tensions and Unemployment

While Sheeler and other machine-age artists painted factories as modern temples, the reality of Depression-era industry proved unhappier. With dark humor, Charlie Chaplin's 1936 film *Modern Times* captured the grim physical and mental stresses of assembly-line labor. The film's boss, leisurely sipping coffee, ordered conveyor belts accelerated to full speed, making it impossible for Chaplin's character to pause in his bolt tightening even to pause to scratch an itch. Chaplin drew on real-life horror stories of Ford spying on his own workers and showed workers affected by what today's doctors call repetitive-stress syndrome, arms involuntarily jerking after making the same movements for hours. The film showed Chaplin's character driven mad by the unrelenting pace, running wildly through the plant destroying machinery and diving headfirst into the equipment, literally getting caught in its huge gears.

The 1930s proved to be a showdown time for auto-industry labor relations. In 1936, members of the United Auto Workers (UAW) mobilized to force General Motors (GM), the world's biggest automaker, to negotiate with the union. In response to wage cuts and production speedups, the UAW mounted a series of work stoppages and then its famous sit-down strikes. Members brought production at Flint, Michigan's Fisher Body Plant to a standstill by refusing to leave and barricading doors with car bodies and steel. Workers stayed warm and dry rather than enduring the miseries of December picketing, while their occupation of the plant reinforced union solidarity and made it impossible for management to bring in scabs. When police and company security tried to storm the plant with teargas and guns, strikers drove them back by throwing metal parts. Workers formed internal committees to keep the plant clean and held daily exercises and classes to keep up morale, while their wives organized and defied police intimidation to deliver food supplies. After forty-four days, GM capitulated and signed a contract giving workers the right to support the union openly. In a subsequent wave of union militancy during early 1937, workers across the country organized more than 100 sit-down strikes, not just in auto plants but also in lumberyards, meatpacking plants, and even laundries and department stores. Major companies such as United States Steel were forced to grant wage increases and union agreements. But although UAW membership soared to half a million, the Ford Motor Company remained a stubborn holdout, obsessed with blocking unionization. In the 1937 "Battle of the Overpass," Ford thugs beat up outnumbered labor organizers (including

women from the UAW Ladies' Auxiliary) who had received a city permit to distribute leaflets on public property near the River Rouge factory gates. Newspaper photographs of the vicious attack drew national attention, and after a bitter strike, Ford was forced to recognize the UAW in 1941.

As Depression woes deepened, Americans expressed growing concern that increasing workplace mechanization had contributed significantly to displacing industrial, agricultural, and service labor. Talk of "technological unemployment" filled union meetings, government offices, and economic conferences. While economists had long analyzed the theoretical relationships between mechanization and employment, the Depression moved such questions out of abstract economic textbooks and into frontpage headlines. The fear was that modern technological change operated too fast for society to keep up, setting off destabilizing consequences in many areas of employment simultaneously, and threatening to render workers obsolete faster than they could be retrained. Roosevelt's 1940 State of the Union address warned that the United States faced a crisis of "finding jobs faster than invention can take them away. We have not yet found a way to employ the surplus of our labor which the efficiency of our industrial processes has created" (Israel 1967, 2853-2854).

Reviewing economic data, government experts confirmed that technological unemployment was a real problem affecting broad segments of American workers. Milwaukee's A. O. Smith factory used electric cranes and conveyors to produce 10,000 automobile frames daily with almost no floor labor; critics denounced the company's "quest for 100% mechanization" as "an iron bouncer" (Bix 2001, 151). Inventions had seemingly revolutionized entire industries almost overnight; one lightbulb-making machine increased production from forty per day to 73,000, supposedly replacing more than 900 workers. Railroad unions claimed that more than 28,000 workers had been displaced since the 1920s by the introduction of automatic loading machines and electric track circuits. Steelworkers complained that new continuous-strip mills had reduced man-hour-per-ton labor requirements by 36 percent since 1923. The United Mine Workers blamed the loss of 78,000 jobs on technological change; one miner's wife wrote President Roosevelt, "The bosses made the men take their tools out of the mine and they are letting coal-loading machines do all the work" (Elderton 1931, 80-81). In agriculture, a 1939 government report estimated that the use of wheat combines requiring only three men to perform tasks formerly requiring ten had displaced some 100,000 farmworkers. John Steinbeck's 1939 *Grapes of Wrath* dramatized agricultural labor's complaints of being "tractored out." Even white-collar jobs seemed threatened; telephone switchboard work had formerly offered an attractive employment option for thousands of women, but with the introduction of new automatic-dial systems, the phone company needed fewer operators. Of course, new machines still required some operatives and repairmen, but as labor leader William Green said, "[A] man laid off in a steel mill where new machinery has just been installed cannot tomorrow take up work as a barber" (Green 1930).

Yet it was not clear that labor could block technological change. Hollywood's Depression-era embrace of sound films reportedly cost almost

10,000 musicians their theater jobs playing the accompaniment for silent movies. The American Federation of Musicians mounted a \$500,000 public relations push to convince audiences to reject scratchy "talking pictures" and insist on beautiful live music; the campaign fizzled within three years. When mine workers called for the elimination of mechanical coal loaders, union leader John L. Lewis blocked the motion, declaring, "You can't turn back the clock and scrap all modern invention. We must see to it that we share in the benefits of the machine in the form of reduced working time and increased compensation" (Lewis 1934, 189-191).

Fears of technological change permeated Depression culture. Cartoonists drew monstrous robots yanking tools out of workers' hands, painting signs reading "No Help Wanted," and literally sweeping workers off the payroll. Science fiction stories, such as John Campbell's *Twilight* (1934) pictured a future when robot domination rendered humans superfluous or even extinct. Even in children's literature, *Mike Mulligan and the Steam Shovel* (1939) told the story of how nobody needed the beautiful steam shovel Mary Anne and her forlorn operator, after powerful new gas, electric, and diesel shovels came along.

Desperation spurred the growth of Technocracy, a small political and intellectual movement that called for shifting from the free market to a managed economy run by engineers, who would make policy decisions purely on the grounds of technical priorities and efficiency. Collecting data in a 1932 "energy survey," director Howard Scott announced that the nation had reached a crucial juncture. Comparing the pre-1900 American economy with gradual technical change to a slow-moving ox cart, Scott declared that just three decades later, the economy had become a racecar about to spin out of control. Since industrialists were determined to speed up assembly lines and embrace mechanization, Scott warned, Americans were locked into a self-destructive cycle of advancing technology and declining employment. Rather than halting change, he decreed, the United States needed to revamp its entire economic structure to fit the rapid pace. Technocracy sneered at mainstream economists for clinging to outdated ideas such as price and profit, calling for a new machine-age economic system centered on calories, foot-pounds, and thermodynamic balance. For a few months, Technocracy attracted significant attention in the popular press, but it quickly lost most of its appeal after mainstream economists challenged Scott's vague gibberish and revealed that he had lied about his background.

America's business community maintained that complaints about technological unemployment were entirely mythical. The Machinery and Allied Products Institute poked fun at complaints that steam shovels replaced 100 men using hand shovels, saying one might equally well argue that machinery had replaced 10,000 men digging with teaspoons. Henry Ford insisted that, in the near future, corporate research and development laboratories would create entirely new industries to both provide new employment for workers and exciting new products for consumers. An extensive 1937 General Electric public relations campaign declared that technological progress allowed middle-class women to buy "two new dresses for the price of one."

Implying that fears of technological unemployment were not only pessimistic but also unpatriotic, ads showing a couple driving a sporty roadster proclaimed that even in the Depression-era United States, "millions of people are wealthy" (General Electric 1937, 357, 454).

In 1927, public concern about the increasing destructiveness of military technology had spurred talk of placing a temporary moratorium on scientific research. Depression-era engineers and scientists feared that the outcry over labor displacement might encourage more calls for a "science holiday." In 1936, Roosevelt told the Society of Arts and Sciences, "I suppose that all scientific progress is, in the long run, beneficial, yet the very speed and efficiency of scientific progress in industry has created present evils, chief among which is unemployment" (Roosevelt 1936). The president's qualified phrase "I suppose," along with the directness of his link between efficiency and unemployment, shocked scientists and engineers, who felt that their life's work was becoming the scapegoat for economic disaster. Caltech physicist Robert Millikan declared flatly, "There is no such thing as technological unemployment," while MIT president Karl Compton added, "The idea that science takes away jobs is contrary to fact, based on ignorance, vicious in its possible social consequences, and yet has taken an insidious hold on the minds of many people" (Compton and Millikan 1934, 297–309).

While controversy over technological unemployment raged throughout the Depression, Americans never approached the point of stopping scientific and engineering work. A type of technological determinism dominated the debate, the notion of innovation as a natural force that could not and should not be restrained. Technological change would come, and society would need to adjust, a conviction reflected in the motto of Chicago's 1933–1934 Century of Progress Exposition, "Science Finds—Industry Applies—Man Conforms."

Technology as Showpiece: Consumer Products and the New York World's Fair

Despite alarm about technological unemployment, the Depression led middle-class Americans to appreciate the benefits of consumer technology more than ever, particularly with regard to entertainment. Radio's technical origins came from the late 1800s, and at first, the power of the "wireless telegraph" to pull sounds from hundreds of miles away out of thin air seemed almost magical. During the 1920s, the number of commercial stations broadcasting skyrocketed. Listening became such a popular sensation among middle-class Americans that Westinghouse and other manufacturers had difficulty keeping up with demand for new sets. By the 1930s, radio's novelty had worn off, yet the Depression only underscored the continued value Americans attached to this new medium of communication. During winter evenings, approximately 40 percent of households would turn on the radio. Roosevelt was the first president to make effective use of radio to share his ideas and promote his agenda of trying to win

A new industry was born—commercial television—on the campus of the 1939 New York World's Fair on April 30, at 12:30 p.m. sharp, when President Franklin Delano Roosevelt opened the Fair with a speech telecast 8 miles away. It took almost two decades for television to become a technically feasible medium. There were scientists and engineers working on television technology in several countries. The technical problems were not simple. How to capture a visual image and transmit it—that required an army of researchers and much trial and effort.

The activities of two Russian immigrants, Vladimir Kosma Zworykin, an engineer, and David Sarnoff, a Russian Jewish immigrant who developed the Radio Corporation of America (RCA) mattered the most. Zworykin was born in 1889, in a small river town, where his father ran a fleet of boats. In 1912, he earned a degree in electrical engineering at the St. Petersburg Institute of Technology; his mentor there insisted that the future of television rested with the cathode ray tube and not the contemporary belief in

public and Congressional support for new programs such as Social Security. His fireside chats brought the president's voice into every living room on a regular basis for the first time, with a powerful immediacy that created a personalized impression of Roosevelt reaching out to ordinary citizens in a common cause. Of course, radio also supplied a vehicle for Roosevelt's critics and demagogues, such as Detroit-based "radio priest" Charles Coughlin, whose demagogic rants against international bankers attracted numerous followers.

In Depression-era radio, music accounted for the majority of programming, giving isolated or poorer Americans the opportunity to hear concerts they could not have attended, enjoying this culture at home in ease and privacy. Stations played everything from classical music and opera to hymns and country music, but radio's accessibility particularly facilitated the spread of jazz music, especially the danceable swing of Benny Goodman and Duke Ellington. Roughly 24.5 million Americans owned at least one radio during the Depression years, providing a ready mass audience for advertisers, who inserted product plugs and jingles into the drama, comedy, suspense, or children's shows that they sponsored. Humorist Jack Benny greeted his audience with the words, "Jell-O, everyone" (Douglas 1999, 121).

The era's most notorious example of the power of radio came with brilliant director Orson Welles's 1938 broadcast of the science-fiction classic *War of the Worlds*, featuring simulated news bulletins about aliens invading New Jersey. Reports suggested that as many as 1 million listeners began packing up to flee or simply panicked, after they missed the identification of the realistic-sounding broadcast as fiction or heard rumors from neighbors. While some historians have since suggested that accounts of mass alarm were sensationalized, Welles did hold a press conference the day following his show to apologize, and the episode became a legendary part of radio history.

Movies emerged from the late nineteenth century primarily as a novelty and cheap amusement for working-class people and non-English-speaking

mechanical systems of capturing and projecting images. During World War I, Zworykin served as an officer in the Czar's army and fled the Bolshevik revolution, settling in the United States in 1919. In the 1920s, he worked for Westinghouse and, eventually, for the Radio Corporation of America; in his spare time he toiled on many inventions, especially on making a viable cathode ray television picture tube. He and Sarnoff met in 1928, when the latter was president of RCA. Zworykin, ever the inventor, told Sarnoff that

it would take only \$100,000 and a few months to perfect television as a commercial industry. Sarnoff, ever the entrepreneur, found that it took fifty millions and eleven years to finish the job. By 1939, television was technologically feasible; New York City had several hundred subscribers, and London, England, about 14,000. By 1939, television was born and developed after World War II.

SOURCE: *New York Times*, April 30, 1939, August 1, 1982.

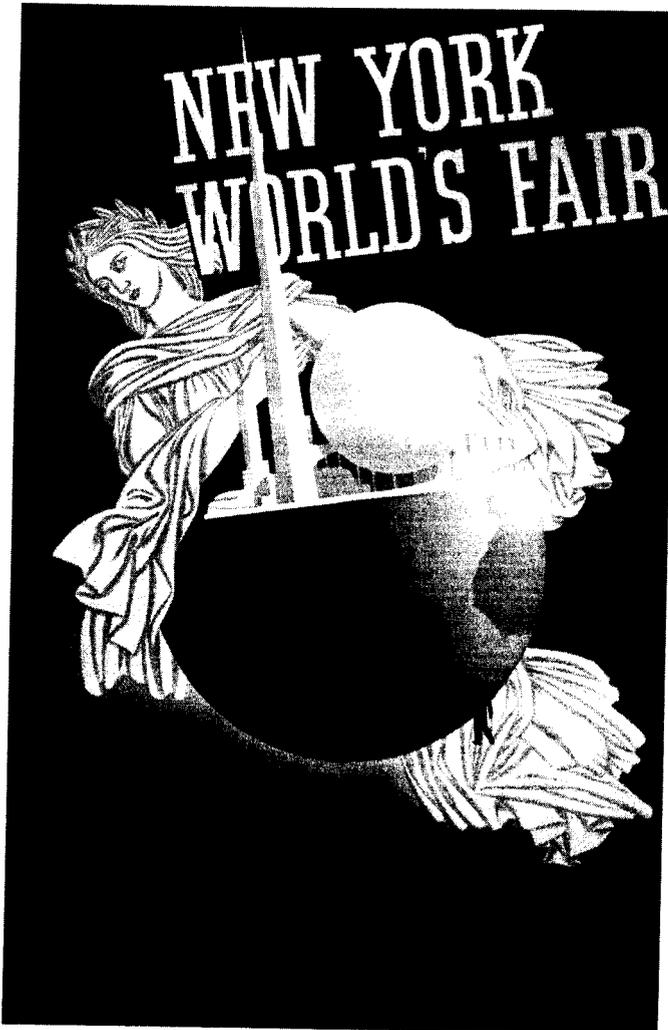
immigrants. But by the 1920s, star-laden features gave films new respectability that increasingly attracted middle-class audiences, as did the glamorous "movie palaces." The Depression cut weekly movie attendance rates by about one-third, and numerous theaters closed. However, construction of more than a dozen grand palaces around the country continued, with their elaborate Art Deco, exotic Orientalist, or Middle Eastern ornamentation designed to make movie-going a thrilling sensory experience. Technological innovations in 1930s films also drew attention; 1927 brought *The Jazz Singer*, the first feature-length "talking picture," and Hollywood continued to experiment with sound over subsequent years. While a few color movies had been made in earlier decades (some with hand-painted frames), refinement of Technicolor processes encouraged studios to produce an increasing number of color features during this era, including Walt Disney's hit *Three Little Pigs* (1933).

Car culture, the ultimate symbol of American consumer well-being and freedom, survived a Depression-era slump. New car sales fell from 4.4 million in 1929 to a low of 1.1 million in 1932; sales rebounded to 3.9 million by 1937, only to plunge again to 2 million as recession hit during the following year. The Depression forced many small automobile manufacturers out of business, leaving the "big three" (Ford, Chrysler, and GM) to dominate the market. Meanwhile, some Americans who owned cars could no longer afford to maintain or drive them and let their registrations lapse. Nevertheless, people continued to prize cars, even used Model T's, as both necessity and pleasure. Between 1929 and 1932, gasoline sales actually increased more than 15 percent, while millions hit the road for family vacations. Many bought trailers to make travel more affordable, while campgrounds did impressive business, as did motel, tourist cottages, roadside restaurants, and other businesses catering to auto travelers.

While the Depression forced many Americans to ration their movie-going, delay purchasing a new car, or otherwise cut back on consumer spending, advertisements promised that technological progress under the

control of corporate enterprise would soon bring a future of fabulous abundance. The business world made such dreams tangible at the 1939–1940 New York World's Fair, where 45 million people came to tour "The World of Tomorrow." Displays entertained visitors with mechanical ingenuity and promises of new consumer goods, overwhelming them enough to preempt any questions about the relationship between technology and unemployment. For example, AT&T enticed visitors by offering free long-distance calls. A gee-whiz demonstration of "What Happens When You Dial" used flashing lights to help crowds trace the path of a call being automatically connected. Switchboard operators who blamed the introduction of the dial system for eliminating their jobs had no such prominent venue to plead their case.

Other fair exhibits drove home the message that, despite unemployment, Americans should be grateful that technological progress already



Poster featuring the Trylon and Perisphere at the 1939 New York World's Fair. The structures at the fair were designed around a futuristic theme. (Library of Congress)

had given them the world's highest standard of living. At DuPont's "Wonder World of Chemistry" offering "better things for better living," "Miss Chemistry" posed in an entire outfit of manmade fibers. Male guests were particularly enraptured by the "leg show" when the girl lifted her skirt to display DuPont's new nylon stockings. "Fabricated from coal, water, and air ... as strong as steel, as fine as a spider's web," DuPont declared, this artificial substance was an improvement on nature (Fenichell 1996, 135). Models at the exhibit played tug-of-war with nylons to demonstrate their miraculous durability, stronger and more affordable than silk, more sheer and sexy than wool or cotton. When nylons hit the market in May 1940, women lined up at department stores before dawn, and although buyers were restricted to one pair each, DuPont's 5 million pairs were gone by evening. Unscrupulous dealers even pretended that silk stockings were nylon, to cash in on the frenzy.

Women coming to New York's Fair enjoyed the Westinghouse homemakers' race, the "Battle of the Centuries," in which "Mrs. Modern" simply loaded the latest dishwasher and pushed the start button, while poor "Mrs. Drudge" covered herself in soapsuds and sweat, washing a sinkful of dishes by hand. RCA's display showing off experimental television broadcasting was mobbed, though it would be years before middle-class families would have their own living-room sets. Further technological astonishment came from Elektro the "moto-man," a humanoid robot who astonished audiences by moving forward on command and counting on his fingers.

The ultimate technological excitement came from GM's "Futurama," where famous designer Norman Bel Geddes carried visitors on a simulated airplane trip over an American city of 1960, showing its triple-deck, fourteen-lane divided superhighways able to keep cars flowing at 100 miles per hour. Twenty-seven million visitors waited two hours or more to enter this technological utopia, where they received souvenir pins reading, "I Have Seen the Future."

As events turned out, Americans would have to wait longer for the automobiles of the future, and it would be more than a decade before television entered middle-class homes. World War II interrupted the promised flow of new consumer goods made possible through the wonders of technology and science. River Rouge and other factories stopped manufacturing new cars for the duration, converting practically overnight to run overtime, producing bombers and tanks. Engineers and scientists left universities to work on top-secret projects such as the development of radar, proximity fuses, and, of course, the atom bomb. The TVA, conceived during Depression, proved vital to defense industry mobilization. TVA electricity supplied the power to run giant aluminum-making factories and nitrate plants crucial for munitions manufacture, as well as the Oak Ridge, Tennessee, laboratory that was busy purifying uranium and producing plutonium for the Manhattan project. Advocates felt sure that American engineering and science would provide the essential edge for an Allied victory, underlining the Depression-era message that technology was what defined modern life.

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