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THE ASSEMBLY LINE

Let us now praise Henry Ford, who imagined the mass market and married it with the grit of the factory.

NO BUSINESS FIGURE casts as long a shadow over the 20th century as Henry Ford. Ford was the godfather of mass production, which, as the century unfolded, became the central organizing principle of America's industry and a defining characteristic of its popular culture. His genius lay in fusing various strands of change--in auto design, in manufacturing methods, in merchandising--into a new concept. He imagined the mass market and married it with the grit of the factory in a way that affected how everyone else thought and acted.

The triumph of the Model T transformed the workplace, the landscape and popular psychology. Luxuries would become necessities: Ford wrote his own law of economic evolution. Until Ford, cars existed as technological toys enjoyed only by the rich. In 1906--almost three years before the Model T went into production--Woodrow Wilson, then president of Princeton University, warned that "nothing has spread socialist feeling in the country more than the automobile." It symbolized, he said, the "arrogance of wealth." These early cars were handmade, expensive and (because so many models existed) erratic. Ford's idea was to standardize design, streamline production, lower costs and make cars available to everyone. "I will build a car for the multitude," he said. And he did.

Even now, the Model T's explosion is breathtaking. Between 1909--the first full year of assembly--and 1913, production went from 17,771 to 202,667; in 1924 (the peak year) it passed 1.8 million. Its price dropped from \$950 in 1909 to \$550 in 1913 to \$355 (with an automatic starter) in 1924. By force of example, the Model T inspired a revolution in business thinking. As new products emerged, they were to be churned out in vast quantities that made the typical American household an ever-expanding repository of consumer conveniences and gadgets. The process began in earnest in the 1920s, when vacuum cleaners, radios and refrigerators came into their own. In that decade, refrigerator production went from less than 5,000 to almost 1 million; radio production jumped from nothing to 5 million. The ramifications ultimately extended beyond the American living room or garage. The feats of U.S. industry in World War II stemmed in part from mass-production practices largely absent in Germany and Japan, notes British historian Richard Overy. "At one point in the war there were no fewer than 425 different aircraft models and variants in production," he writes in his book, "How the Allies Won." "By the middle of the war the German army was equipped with 151 different makes of lorry [trucks], and 150 different motor-cycles ... With such variety it was difficult to produce in mass."

Growing up on a farm near Dearborn, Mich., Ford became a compulsive tinkerer at an early age, learning to fix watches and rejecting (to his father's horror) farm life. "He loathed plowing and planting, feeding and milking," wrote biographer Roger Burlingame. In 1879 the 16-year-old Ford found an apprenticeship at a shop in Detroit that made steam engines. By the early 1890s he had become the chief engineer of the Edison Illuminating Co., one of the nation's first electric utilities. But what absorbed his enthusiasm was his off-hours tinkering: in a woodshed behind his home, he was building a "horseless carriage." He finished in early 1896 and took his primitive car, mounted on bicycle wheels, for a spin around the block.

It would be more than a decade until the Model T, years that reflected the early auto industry's exuberant chaos. In 1900 the first National Automobile Show in New York City featured 40 car companies, and William McKinley became the first president to ride in a car.

Ford was simply one ambitious player in a swarm of early automakers. Nor had the United States invented the car. That distinction belonged to Germany, where Nikolaus Otto built the first practical internal-combustion engine in 1876, and Karl Benz and Gottlieb Daimler built what are regarded as the first modern cars in the mid-1880s. But Americans pioneered in commercializing the car.

What ultimately separated Ford from his competitors was his concept and obstinacy: his decision to build only one model of car--a move opposed by some of his own managers and investors. Until the Model T, many car components were so inexact that they often had to be reworked individually on expensive machine tools (cutting or grinding machines) so that they would fit and function. Cars were assembled one by one, with workers fetching parts as needed. Car models changed frequently, so that long production runs for most parts were impossible. By avoiding constant design changes, Ford standardized parts and improved the use of machinery. Ford, his mechanics and engineers constantly improvised. One thing led to another. To ensure uniform parts, machine tools were rearranged: all the machines needed for a specific part were grouped together. Before, all the machine tools of one type (say, cutting machines) were put together. Car assembly was broken down into many subassemblies (rear axles, engines, dashboards) and all parts

for a subassembly were stored in bins around the workbenches. This freed workers from having to walk to get each new piece. After that came the assembly line in 1913.

This produced an upheaval of people as well as of machines. As production was simplified into more routine tasks (fastening a bolt, stamping a part, connecting two components), skill levels declined sharply. So did Ford's dependence on experienced craftsmen. By 1914 three quarters of the burgeoning work force were recent immigrants. The stress and monotony of Ford's jobs was disaffecting; in 1918, turnover was almost 400 percent. To minimize these problems, Ford decided in early 1914 to double the lowest wage, from \$2.84 to \$5 a day. The announcement was made with typical bombast: "The Ford Motor Company, the greatest and most successful in the world, will on January 12 inaugurate the greatest revolution in the matter of rewards for its workers ever known to the industrial world."

Higher wages worked wonders. By 1915 absenteeism had dropped roughly 85 percent. Ford restricted the \$5 wage to workers with at least six months on the job--a sensible limit, because he wanted to promote stability. And he conditioned the higher wage on good behavior, a more novel requirement. Through a Sociological Department of his company, Ford counseled workers to take baths, avoid excessive drinking, save to buy a house and keep a tidy home. A force of 150 inspectors visited homes to qualify workers for their payments. This earned Ford a reputation for being both paternalistic and authoritarian.

Ford's factory revolution triggered a broader economic and social upheaval. By the 1920s, the car belonged to the masses both in fact and in spirit. In 1910 there were only 458,000 cars registered in America. A decade later the total was 8 million, and by 1930 it had reached 23 million. Though many poor families still didn't own a car, this was almost one car per household. When sociologists Robert and Helen Lynd interviewed families in Muncie, Ind., in the 1920s for their famous study "Middletown," they found that the car had burrowed deeply into popular consciousness. One housewife pointed out that her family owned a car but not a bathtub. "Why, you can't go to town in a bathtub!" she said.

Improvements in cars and roads fed on each other: the better cars got, the more Americans wanted better roads. And there was much to improve. Outside major cities, few roads were paved. The first national road survey, conducted by the Agriculture Department in 1904, classified 154,000 miles (7 percent) of the 2.15 million miles of rural roads as "surfaced," but the surfaces consisted mainly of gravel or crushed stone. In cities, some major streets had solid stone pavements. Broadway in New York used granite blocks 10 inches thick, laid on a six-inch concrete base.

Everything about road-building and traffic control affirms the cliched truth: necessity is the mother of invention. There were few breakthroughs and many small improvements. What worked, spread; what didn't, died. The first modern electric traffic light is usually attributed to Lester Wire, the head of the traffic detail of the Salt Lake City police. He installed it in 1912 to control the disarray on local streets. In 1920 Marquette County in Michigan pioneered the use of a white center line to keep cars in their lanes. Two years later Wayne County (which includes Detroit) devised a truck-mounted striping machine. This improved efficiency dramatically; with the truck, two men could paint six or seven miles a day; by hand, four men painted only a mile a day. In 1940 the first two modern freeways opened; the Pennsylvania Turnpike in October and the Pasadena Freeway in December. By then the United States had 1.4 million miles of paved roads, 42 percent of the total.

The new car culture didn't create new values. It simply expressed old ones (freedom, equality, individualism) in new ways. If people traveled, they needed to eat, sleep and refuel. Farmers soon allowed motorists to pitch tents on bits of field. Then cabins sprouted. By the 1930s the country had an estimated 15,000 cabin camps, usually consisting of 10 to 15 sparse and inexpensive (say, \$2 a night for a couple) cabins. The young writer James Agee, reporting for *Fortune* in 1934, called these protomotels a "sound invention and a new way of life." Not everyone agreed; some critics poked fun at the austere camps. "The point that the satirist misses when he lampoons American folkways is that most folkways make sense," Agee wrote. "The American people have created the cabin camp because the hotel failed them in their new objective--motion with the least possible interruption." The same verdict could be rendered of most of the roadside commerce that subsequently emerged.

Travel made Americans crave the familiar. They didn't want every roadside meal or overnight stay to be an adventure--and possibly a bad one. So arose the Holiday Inns and the Howard Johnsons: the motel and fast-food chains whose appeal lay in standardization. Similarly, cars promoted suburbanization, and suburbanization created a demand for nearby shopping from which came regional shopping centers (the first was Northgate, outside Seattle, in 1950) and covered, air-conditioned malls (the first was Southdale in suburban Minneapolis, in 1956). The chains and shopping malls represented innovation, too. New needs spawned new forms of commerce and fierce competition. Everyone wanted the best locations and more of them. "This is rat eat rat, dog eat dog," Ray Kroc, McDonald's founder, once said of the fast-food industry. "I'm going to kill them before they kill me."

As a parable of technology's power, the car has few rivals. It contributed to the erosion of family, authority and community by making it easier for people to pick up and go wherever and whenever they wished. For the same reason, it broadened their horizons and homogenized America. Along with some other great technologies (the telephone, the plane, the television and air conditioning), it reduced the vast differences among regions that had existed before World War II. A more mobile society was a less parochial one. And, of course, it helped impoverish cities by draining away productive citizens and profitable enterprises. Even as it liberated, it also destroyed.

All this occurred without being planned or particularly predicted. Technology operates by triggering thousands of small and large ripples-in other technologies, industries, lifestyles and popular attitudes. It is no stretch to say that Steve Jobs and Bill Gates are the heirs of Henry Ford. They, too, are peddling a new technology for the masses. Ironically, this relentless and often unforgiving process ultimately caught Henry Ford in its undertow. His triumph also became his undoing, because the world in the mid-1920s was no longer the world that had embraced the Model T. Better roads and better cars--enclosed and bigger--hurt the Model T. A used-car market had emerged; so had installment buying. Both changes made costlier cars more affordable. Ever stubborn, Ford tinkered with the Model T but clung to the basic design. When the end came, it arrived swiftly. In 1925 Ford's market share slipped below 50 percent. Sales continued sliding in 1926. By 1927 the Model T was finished. Though the company recovered, it never regained its dominance. The man and his car had become victims of their own success.

ILLUSTRATION

PHOTO (BLACK & WHITE): Wheels of Progress Mass production drove volume up and prices down

PHOTO (BLACK & WHITE): Transforming the Landscape Henry Ford (left) and his son, Edsel, next to a Model T

PHOTO (COLOR): These Arches Were Paved With Gold A nation in perpetual motion stopped to fill up on fast food

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By ROBERT J. SAMUELSON

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