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The Industrial Revolution

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The Industrial Revolution (which was not really a revolution, because the changes evolved over a period of decades) began in the third quarter of the 18th century and accelerated into the second quarter of the 19th. The rapid increase of per capita income that accompanied it did not necessarily entail an improved standard of living; in fact the median standard of living probably declined until the second quarter of the 19th century. The Industrial Revolution brought a great deal of hardship, but offered for the first time in history sustained real per capita growth.

Technology has been described as science in the service of industry and commerce. If that is so, the real revolution—what we may term the "Second Industrial Revolution"—took place in the last portion of the 19th century. Prior to that there was not much application of science to industry as a loose assortment of inventors and tinkerers using ancient knowledge about steam, water power, and wind power, and amplifying them by mechanical means to increase production of things like yarn, crops, and pig iron. The importance of steam technology to coal mining (for pumping water out of deeply dug mines) led to particularly intense technological development in regions rich in coal—i.e., England and Belgium. The late 19th century also saw developments in optics, the chemical industries, and the generation and distribution of electricity that were truly revolutionary. Petroleum began to be used not only as a fuel (locomotion, water transportation) as well as substituting for tallow and whale oil for lighting, but in chemical and electrical processes.

Advances in metallurgy at this time were of particular significance. The quantity of genuine scientific knowledge the field now required altered the educational system (especially in the United States, England, and above all Germany), and the increased hardness of the steel produced enabled a degree of precision never before attainable, making possible the production of interchangeability of parts—a core feature of industrial technology. Early efforts at interchangeability—e.g., in the manufacture of revolvers (Colt)—failed because metals were too soft and required too much manual fitting.

Why did technological innovation occur in one place but not in another? On this question, Professor Abrams recommended David Landes's 1998 work *The Wealth and Poverty of Nations.* The book is often criticized for being Eurocentric, but Abrams argued that "Eurocentrism in this case is nothing but the truth: the history of the world in the last half-millennium has been largely the history of European expansion"; and European-born philosophies—including Marxism—have achieved global prominence, if not dominion. Medieval Europe was a mere backwater, especially when compared with the intellectual and material luster of China, South Asia, and the Middle East.

Yet by the end of the 16th century, Europeans, most scientists would agree, "knew more than people elsewhere in the world," and were richer on a per capita basis. England, by the beginning of the 18th century, had a higher per capita income than many developing countries today. It also boasted the novelty of a ruling class that, unlike their equivalents elsewhere, was greatly interested in scientific development, and had a tradition of "getting their hands dirty" (behavior one would not encounter in the work of Jane Austen, Abrams said, as her entire œuvre was concerned with how to *avoid* going to work).

The transformation of Europe from a region focused on life after death, asceticism, and an almost mystical spirituality into probably the most materialistic culture the world has ever seen, had as prime catalysts the Protestant Reformation, the work of Calvin and Luther, and the notion of an individual relationship to God, with its implicit challenge to institutional authority. With the desire to read Scripture in the vernacular came the need for education and literacy; with the shift from a priestly to an individual religious practice came the idea that to do one's own work *well*, whether one's work is in a palace or a turnip field, is to do God's work.

This revolutionary idea of individual achievement and reward, in labor as well as in religion, galvanized the working public. They may have been unaware of participating in a revolution, and Malthus's doomsaying regarding the perils of affluence may still have reverberated in the public mind, but people left their cottages and their villages and swarmed to the factories and the cities nonetheless, in an attempt to improve their lot. Using their employers' machines rather than their own tools, with water or steam rather than animal power, separated from family and home village, these workers may be said to have had their lives truly revolutionized.

Other factors in the rise in industrialism in the northwestern corner of the Euro-Asian landmass, in contrast to developments elsewhere, included the use of the rotary steam engine for locomotion, which expanded the market for producers thereby providing an incentive for increased—i.e., mechanized—production. Perhaps most important of all for the advantage that England enjoyed was the long period of relative political stability following the end of the War of Roses in 1485. The U.S. had a similar advantage after the War of 1812. (Stability can also prove inimical to progress, Abrams pointed out, as the example of tsarist Russia demonstrates.) The vast Chinese empire underwent frequent upheaval, and had long considered the Confucian ideal of continuity preferable to the Western idea of progress: neither feature was conducive to technological development. It is true that Europe took many inventions from the East, gunpowder (possibly invented independently in the West, and used by the Chinese only in fireworks), and the clock (which had disappeared in China by the 17th century, except for those specimens turned into "pornographic machines") among them.

Audience Member: What are "pornographic machines"?

Richard Abrams: Well, when you've got something geared for repetitive action. . . . There are many things you can do with gears.

Again, why were the United States and England able to produce sustained economic growth over the course of a century, while other countries with substantial natural endowments (Venezuela, for example) were not? W. W. Rostow tried to quantify the attainment of sustained growth in his

Stages of Economic Growth, arguing that political stability resulted in (and depended on) laws that protected property and contracts, and there existed (at least in England and the U.S.) a confluence of economic development with the development of democracy. Economists were beholden to him for having opened up the question; his conclusions were enthusiastically tested . . . and found to be wrong. In both England and the United States, democratic institutions came after economic development, rather than preceding it. Economic development undeniably occurred in 19th-century America, yet racism, subordination of women, limitations on electoral franchise, and other undemocratic abuses characterized political life throughout the 19th century in the U.S. and the UK, conditions that today we somehow find unacceptable among newer industrializing countries. Economic growth in China and the Soviet Union clearly occurred without the development of democratic institutions. The Soviets' accomplishments under the aegis of a *command* economy—not a democratic one—in the 20th century was sensational, and contributed to the USSR's successful resistance of the German economy's bid for Central European hegemony and, contended Abrams, the winning of World War II. The Russians had more men and better equipment than any of the other Allies: the only tanks that were a match for the German Panzers were the Russians'. The Germans had fewer tanks than their foes, were unable to supply replacement tank parts to their troops, and, ultimately, ran out of fuel. That, and the Russians, is what stopped Germany—not the U.S. or England.

Q&A

Q: What *is* the theory as to why Venezuela has not been able to capitalize on its resources?

A: Explanations for South America's slow development generally focus on the domination by the Church, and onthe preference for landholding over other economic activity. There has also been an observed tendency of the elite classes to look down on people who produce things. Yes, this is true to some extent in England, but less so. South American culture has not been friendly to entrepreneurial culture and change.

Another example is that of Argentina. With the European immigration came the establishment of big haciendas, plantations, to produce food and materials, and that's it. They needed markets, export. They needed railroads, port facilities, ships—customers in Europe; and they got these from British investors. There are cultural barriers there that cannot be overlooked. But things are achanging.

Q: Weren't Indian labor and resources exploited in England's Industrial Revolution?

A: England, France, and Portugal got into the subcontinent very early, but mostly along the coast as entrepôts. They built port facilities and exploited cheap labor, certainly, and they forbade the Indian export of cloth. There's exploitation everywhere [in the history of economic development]; Japan rose on the backs of its women.

Q: There was a 19th-century English pushback against the Industrial Revolution: is that a natural cycle—the culture's response to machines—and why human rights developed?

A: The late development of human rights has to do with the late development of human empathy. You can read in the newspapers the push by today's Republicans to reduce or eliminate aid to the poor and otherwise disadvantaged. Underlying this is an ideology that once dominated thinking in the 19th century; namely that everyone should be held responsible for his/her own well-being—that subsidizing the poor only increases their addiction to "dependency." As the renowned 19th-century British Social Darwinist Herbert Spencer put it, for government to intervene in the misfortunes of the poor is to "bequeath to posterity an ever increasing curse." This is an example of the low level of empathy in our past, a level raised only in the past seventy-five years or so, and one to which we are in danger of returning.

Q: Agricultural production has to increase in order to industrialize. You just mentioned Japan's industrialization in the end of the 19th century; they had no opportunity to increase resources, so what did they do instead?

A: They exported goods and used foreign currency to buy food. They also went to war (against Korea, against China) to expand control over food and fuel resources. For its part, Britain went off agriculture in the 1840s and focused on machinery in its place.

Q: Japan colonized Korea for that reason—to monopolize their rice production. Also they did have famines in which a lot of people died.

A: That's what happens with progress: a lot of people die. Or at least that is what happens when a country's political leadership fails to empathize with the disadvantaged.

Q: What was the effect of labor unions on industry?

A: Especially in Europe, unions have been remarkably successful in raising real median income and in stimulating a robust economy. They also have played an important role in maintaining political stability. On the other hand, in *some* cases unions tended to obstruct progress (like the Luddites destroying industrial equipment). Unions were generally successful in raising wages. Most Western economies are not dependent on capital goods, but on consumer goods—for which you have to have consumers. Labor unions therefore helped make possible the consumer society.

Another point I'd like to make involves the role of government in economic development. The idea that a market ecnomy depends on the absence of government intervention is totally false. Go back to the late 18th century: the government determined wages, the size of bread—all aspects of work were controlled by the government. Most of that kind of control, that is, of the state mediating between actors in economic relationships, remained throughout the 19th century in England and the U.S. One remnant of this kind of intermediation is marriage: you have to have a license, rendering the state an intermediary. Throughout the 19th century government controlled the relationship of employers and employees; the notion of "free labor" developed slowly in practice as the law of contracts replaced the government as intermediary.

Although the federal government got into the act relatively late in the U.S., state governments closely regulated banks, manufacturers, public utilities, and mining companies. Government also

produced the infrastructure and much of the research that underlay industrialization in the UK and the U.S. throughout those countries' history.

Q: Did you say the U.S. is not a consumer society? Why?

A: Because our laws are almost entirely for producers, not consumers. During a brief period in the 1960s there was some consumer protection law, but by 1976 it's all over. See my article in *Dissent*, Spring 20080021