INDUSTRIAL REVOLUTION

Coal, Steam, and the Industrial Revolution: Crash Course World History #32

Though the Industrial Revolution happened around the same time as the political revolutions from Unit 2, it was arguably more revolutionary in how it changed the lives of people living on this planet. Almost every aspect of human life changed because of the Industrial Revolution. John Green explores the origins of the Industrial Revolution in Britain and as well as several key that made all these changes possible.

00:01

Video shows the studio in which Crash Course is filmed, the outside of the warehouse, and a bunch of objects that are stored in the warehouse

Hi, I'm John Green, this is Crash Course World History, and today we're going to discuss the series of events that made it possible for you to watch Crash Course. And also made this studio possible. And made the warehouse containing the studio possible. A warehouse, by the way, that houses stuff for warehouses.

That's right, it's time to talk about the Industrial Revolution. Although it occurred around the same time as the French, American, Latin American, and Haitian Revolutions, between, say, 1750 and 1850, the Industrial Revolution was really the most revolutionary of the bunch.

John Green as his past self

No way, dude, all those other revolutions resulted in, like, new borders and flags and stuff.

Present John Green sighs

We've studied 15,000 years of history here at Crash Course, Me from the Past. And borders and flags have changed plenty, and they're going to keep changing. But in all that time, nothing much changed about the way we disposed of waste or located drinking water or acquired clothing. Most people lived on or very close to the land that provided their food. Except for a few exceptions, life expectancy never rose above 35 or below 25. Education was a privilege, not a right. In all those millennia, we never developed a weapon that could kill more than a couple dozen people at once, or a way to travel faster than horseback.

Montage of artworks depicting early farming methods
A painting of a butcher shop

01:05

For 15,000 years, most humans never owned or used a single item made outside of their communities. Simon Bolívar didn't change that and neither did the American Declaration of Independence. You have electricity? Industrial Revolution. Blueberries in February? Industrial Revolution. You live somewhere other than a farm? Industrial Revolution. You drive a car? Industrial Revolution. You get 12 years of free, formal education? Industrial Revolution. Your bed, your antibiotics, your toilet, your contraception, your tap water, your every waking and sleeping second? Industrial Revolution.

Windmills

CCWH theme music plays

01:49

Here's one simple statistic that sums it up—before the Industrial Revolution, about 80% of the world's population was engaged in farming to keep itself and the other 20% of people from starving. Today, in the United States, less than 1% of people list their occupation as farming. I mean, we've come so far that we don't even have to farm flowers anymore. Stan, are these real, by the way? I can't tell if they're made out of foam or digital. So what happened? Technology!

Painting of women on a farm; contrasting pie charts show the differing percentages;
Green points to some foam flowers in a vase next to him

Here's my definition, the Industrial Revolution was an increase in production brought about by the use of machines and characterized by the use of new energy sources. Although this will soon get more complicated, for our purposes today, industrialization is not capitalism, although, as we will see next week, it is connected to modern capitalism. And the Industrial Revolution began around 1750 and it occurred across most of the earth, but it started in Europe, especially Britain. What happened? Well, let's go to the Thought Bubble.

Map of the globe from 1700s

02:38

The innovations of the Industrial Revolution were intimately interconnected. Like,

Animation: a woman working in a textile factory works at a mechanical loom (the flying shuttle); animation of a water turbine
Animation of a coal mine

look, for instance, at the British textile industry The invention of the flying shuttle by John Kay in 1733 dramatically increased the speed of weaving, which in turn created demand for yarn, which led to inventions like the spinning jenny and the water frame. Soon these processes were mechanized using water power, until the steam engine came along to make flying shuttles really fly in these huge cotton mills. The most successful steam engine was built by Thomas "They Didn't Name Anything After Me" Newcomen to clear water out of mines. And because water was cleared out of those mines, there was more coal to power more steam engines, which eventually led to the fancying up of the Newcomen steam engine by James "I Got a Unit of Power and a University Named After Me" Watt, whose engine made possible not only railroads and steamboats but also ever-more-efficient cotton mills.

Railroad and steamboats

03:27

People working in a textile factory; urine drips off of a piece of fabric; animated sulfur mine, lead mine

And for the first time, chemicals other than stale urine—I wish I was kidding—were being used to bleach the cloth that people wore, the first of which was sulfuric acid, which was created in large quantities only thanks to lead-lined chambers, which would've been impossible without lead production rising dramatically right around 1750 in Britain, thanks to lead foundries powered by coal.

Woman works at the textile factory, CCWH t shirts are produced

And all these factors came together to make more yarn that could be spun and bleached faster and cheaper than ever before, a process that would eventually culminate in $18 Crash Course Mongols shirts. Available now at DFTBA.com. Thanks, Thought Bubble, for that shameless promotion of our beautiful, high-quality t-shirts available now at DFTBA.com.

04:08

So, the problem here is that with industrialization being so deeply interconnected, it's really difficult to figure out why it happened in Europe, especially Britain. And that question of "why" turns out to be one of the most contentious discussions in world history today. For instance, here are some Eurocentric reasons why industrialization might have happened first in Europe.

There's the cultural superiority argument that basically holds that Europeans are just better and smarter than other people. Sometimes this is formulated as Europeans possessing superior rationality. By the way, you'll never guess where the people who make this argument tend to come from, unless you guessed that they come from Europe. And then others argue that only Europe had the culture of science and invention that made the creation of these revolutionary technologies possible.

04:45

Harp music plays, a fireplace rolls into the scene and John Green moves into a leather chair, pulls a toy TARDIS (a fictional time machine) from the compartment

Another argument is that freer political institutions encouraged innovation, and strong property rights created incentives for inventors. And, finally, people often cite Europe's small population because small populations require labor-saving inventions.

Oh, it's time for the Open Letter? (music playing) An open letter to the steam engine. But first, let's see what's in the secret compartment today. Oh, it's a TARDIS. Truly the apex of British industrialization.

Points to the TARDIS

Dear Steam Engine, You know what's crazy? You've really never been improved upon. Like this thing, which facilitates time travel, probably runs on a steam engine. Almost all electricity around the world, whether it's from coal or nuclear power, is just a steam engine. It's all still just water and heat, and it speaks to how truly revolutionary the Industrial Revolution was, that since then, it's really just been evolution. Best wishes, John Green.

05:35

So, you may have heard any of those rationales for European industrialization, or you may have heard others. The problem with all of them is that each time you think you're at the root cause, it turns out there's a cause of the root cause. To quote Leonardo DiCaprio, James Cameron, and coal mine operators, "We have to go deeper." But, anyway, the problem with these Eurocentric "why" answers, is that they all apply to either China or India or both. And it's really important to note that in 1800, it was not clear that Europe was going to become the world's dominant manufacturing power in the next hundred years. At the time, China, India, and Europe were all roughly at the same place in terms of industrial production.

06:08

an early Chinese text, montage of Chinese art

Black and white photo of a Chinese export ship John Green knocks down the foam vase of flowers

Chinese art, including a drawing depicting the making of paper, and a large compass

First, let's look at China; it's hard to make the European cultural superiority argument because China had been recording its history since before Confucius, and plus there was all that bronze and painting and poetry. It's also kind of difficult to make a blanket statement that China was economically inferior to Europe, since they invented paper money and led the world in exports of everything from silk to... china. I mean, pre-Industrial Revolution, population growth was the surest sign of economic success, and China had the biggest population in the world. I guess that answers the question of whether they're digital.

It's also difficult to say that China lacked a culture of invention when they invented gunpowder, and printing, and paper, and, arguably, compasses. And China had more free enterprise during the Song dynasty than anywhere in the world. Some argue that China couldn't have free enterprise because they had a long history of trying to impose monopolies on items like salt and iron. And that's true, but when it comes to enforcing those monopolies, they also had a long history of failure. So really, in a lot of ways, China was at least as primed for an industrial revolution as Britain was. So, why didn't it happen?

07:03

Photo of a coal-powered engine, photo of an early industrial factory

Drawing depicts a man being hit in a coal mine explosion
A coal-powered factory belches polluting smoke into the sky

Well, Europeans, specifically the British, had two huge advantages—first, coal. When you trace the story of improved transportation, or communication, or industrial efficiency, or better chemical manufacturing, it always comes back to coal, because the Industrial Revolution was all about using different forms of energy to automate production. And England had large supplies of coal that were near the surface, which meant that it was cheap to mine, so it quickly replaced wood for heating and cooking and stuff. So that encouraged the British to look for more coal. The only problem with coal mining, aside from it being, you know, like, deadly and everything, is that the coal mines flooded all the time. I guess coal mining is also a little problematic for, like, the health of, you know, like, the planet. But because there was all this incentive to get more coal out of the ground, steam engines were invented to pump water out of the mines. And because those early steam engines were super inefficient, they needed a cheap and abundant source of fuel in order to work—namely, coal—which meant they were much more useful

to the British than anyone else. So steam engines used cheap British coal to keep British coal cheap, and cheap British coal created the opportunity for everything from railroads to steel which, like so much else in the Industrial Revolution, created a positive feedback loop. Because they run on rails, railroads need steel. And because it is rather heavy, steel needs railroads.

08:13

Secondly, there were wages. Britain, and to a lesser extent the Low Countries, had the highest wages in the world at the beginning of the 18th century. In 1725, wages in London were the equivalent of 11 grams of silver per day. In Amsterdam, they were nine grams. In Beijing, Venice, and Florence, they were under four. And in Delhi, they were under two. It's not totally clear why wages were so high in Britain. Like, one argument is that the Black Death lowered population so much that it tightened labor markets, but that doesn't explain why wages remained low in, like, plague-ravaged Italy.

Paintings depict the black death: sick and dying people in the streets

08:40

Mainly, high wages combined with cheap fuel costs meant that it was economically efficient for manufacturers to look to machines as a way of lowering their production costs. To quote the historian Robert Allen, "Wages were high and energy was cheap. "These prices led directly to the Industrial Revolution "by giving firms strong incentives "to invent technologies that substituted capital and coal for labor." Ugh, Stan, I'm a little worried that people are still going to accuse me of Eurocentrism. Of course, other people will accuse me of an anti-European bias. I don't have a bias against Europe. I love Europe, Europe gave me many of my favorite cheeses and cross-country skiing, and Charlie Chaplin, who inspired today's Danica drawing.

scrolling text

John Green points to a drawing on the chalkboard

Like, the fact of coal being near the surface in Britain can't be chalked up to British cultural superiority.

09:22

But the wages question is a little different because it makes it sound like only Europeans were smart enough to pay high wages. But here's one last thing to consider. India was the world's largest producer of cotton textiles, despite paying basically the lowest wages in the world. Indian agriculture was so productive that laborers could be supported at a very low cost. And that, coupled with a large population, meant that Indian textile manufacturing could be very productive without using machines, so they didn't need to industrialize.

Birds-eye view of a farm in India; Photo of a woman's hands weaving

But more importantly from our perspective, there's a strong argument to be made that Indian cotton production helped spur British industrialization. It was cotton textiles that drove the early Industrial Revolution, and the main reason that Britain was so eager to produce cottons was that demand was incredibly high. They were more comfortable than woolens, but they were also cheaper, because cottons could be imported from India at such a low cost. So, Indian cottons created the market and then British manufacturers invested in machines, and imported Indian know-how, to increase production so that they could compete with India. And that's at least one way in which European industrialization was truly a world phenomenon.

Photo of a British manufacturing facility; drawing depicts Indian men working in production, likely representing the Indian influence on British manufacturing

10:18

For those of you who enjoy such highly contentious and thorny cultural-historical debates, good news. Next week, we'll be talking about capitalism. Thanks for

watching, I'll see you then.

Credits roll

Crash Course is produced and directed by Stan Muller. Our script supervisor is Danica Johnson. The show is written by my high school history teacher, Raoul Meyer, and myself. We are ably interned by Meredith Danko. And our graphics team is Thought Bubble. Last week's phrase of the week was "The New England Revolution," that was challenging. If you want to suggest future phrases of the week or take a guess at this week's, you can do so in comments, where you can also ask questions about today's video that will be answered by our team of historians. Thanks for watching Crash Course, and as we say in my hometown, don't forget to be awesome.