What Makes Time Tick, or Has The Industrial Revolution Really Made Clocks Go Faster?

“Everyone’s always muttering these days,” The pace of life sure has speeded up; you hardly have time to think now.” “You didn’t get this kind of pressure back in horse-and-buggy days.”

Time itself, of course, is not what has changed. It remains a mysterious dimension of our experiences and actions. Nor is the measured amount of time in each daily cycle of 24 hours any different now than when this country began.

Whatever has changed, though, is the way activities are timed within these 24 hours. Two centuries ago, most Americans’ time was loosely structured compared to our own—somewhat more flexibly scheduled, more slowly paced, more under each individual’s personal control. But nowadays as we approach the end of the 20th century, most Americans live in a world of rigid schedules, fast tempos, and short response-times . . . a world that evolved out of the complex changes that we call the industrial revolution.

In the course of the 19th century, the United States changed from a primarily agricultural country into the world’s leading industrial nation. This industrialization transformed virtually every aspect of American life. Increasingly precise scheduling and stepped-up tempo...
common in England by this time, in the United States most manufactured products are still made by hand, by individuals—sometimes within a family, for their own use or as a business, for sale to customers in the local community. One skilled craftsperson often carries out all the steps involved in the manufacture of his product. He has learned the skills he needs through an apprenticeship of many years . . . and his skill shows up in the quality of his product.

If you look through the open doorway of that shop there, along this cobble-stoned street, you will see a shoemaker inspecting a pair of boots he has just finished making. He turns them over, looks inside. Then he smiles as he polishes the leather with a soft cloth.

100 years ago. Zip ahead now 100 years, to the 1890s. The United States you see below you now is three times bigger than a century before; it stretches all the way to the Pacific. Many more towns and cities have been built, especially in the northeast quarter of the country. These include some much bigger cities than existed on your first visit. The cities no longer seem isolated to you the way the earlier towns did. As you look down, you can see three different networks* connecting them: a rather poorly-developed road network, a slender but well-maintained network of telegraph wires, and a heavy network of railroad tracks.

Timing Goes National: Coordinating Big Systems

In the old days, as you saw on your first stop, it was individuals who produced most manufactured goods. An individual craftsperson produced in small quantities, for local customers. But now, at the end of the 1890s, it is factories that turn out most manufactured goods. Mechanized factories can produce enormous amounts, far more cheaply and faster than any craftsperson could possibly produce them.

But because all the factory buildings and machines and coal cars a lot, the factory must sell a lot to stay in business. There are not enough buyers locally, so factories have to ship part of their output to other places around the country.

One result of this is that producers and buyers, suppliers and shippers all over the country have come to do business with each other and depend on each other: the American economy has become national.

Even American time has become organized on a national basis. Just a few years before this visit of yours, each community in the United States still had its own local time. As the economy became national, this hodge-podge of local times became increasingly inconvenient, especially for railroads. Each station a train passed through might be on a different time system from its neighbors. In 1883, with the establishment of standard time zones for the whole country, time itself was organized into a larger system. Standard time zones made coordination easier . . . but usually, as a system becomes bigger, it becomes harder to manage. This is true of factories, of railroads, and of the entire interlocking economic system described a couple of paragraphs ago.

The shoemaker you saw back in the 1790s had no trouble keeping track of his business. He could easily hold in his own head all the information he needed: he knew what he had promised his customers, how much leather he had, how fast he (and his apprentice, if he had one) could work, whether any of his tools needed fixing . . .

But 100 years later, the owner of a large factory could not possibly just depend on his own memory to keep up with all his factory’s employees, departments, suppliers, buyers, and shippers. As systems get big, keeping track of—and controlling—what is happening everywhere in the system becomes a major part of the system’s work: getting up-to-date feedback, comparing what is going on in one place with what is going on in another, communicating this information to wherever it is needed, storing it in clear records for future use . . . all this processing of information becomes essential to making sure that the right thing is being done at the right time.

By the 1890s, more and more people—managers, clerks, telegraphers, telephone operators—are working at jobs that involve the processing of information. And more and more innovations—the telegraph, the telephone, the typewriter, carbon paper, the calculating machine—that help gather, communicate, process, and store information are coming into common use.

All this effort is costly, but essential. Even small mistakes in timing can be disastrous: if a vital supply does not arrive on time, it should, a factory’s production can be forced to a complete stop; if the timing of two trains running along the same track is off by even a few seconds, the trains may crash.

Along this network of tracks, trains rush in all directions, whipping factory-made goods to buyers around the country . . . and carrying passengers all the way from New York to California in 3½ days!

You swoop down low to take a closer look. A locomotive whooshes past you, black coal smoke pouring out of the smokestack . . . the same coal smoke that now pours out of factory chimneys around the country: since your first stop, the United States has become the world’s leading industrial nation. And it is no longer animals or people, water or wind—but coal—that drives the engines of its industries.

Coal can produce power enough to run machines of any size . . . as fast as you want . . . as long as you want . . . around the clock, if that will make more money. Unlike animals, coal-powered machines never get tired.

This new source of energy, combined with the machinery it drives, has eliminated the brakes that used to slow the pace of work.

How has this affected the lives of working people? To find out, take a look inside a factory, a textile mill.

You see a huge room crowded with huge machines. Men, women, and children tend these machines. Some of the children are so small they have to stand on boxes to reach the equipment they operate.
The room is full of dust and noise. Wheels, metal parts clatter. You watch one child carry out his task: when the yarn breaks, he has to go in past moving machinery to tie it up (if it moves slowly), he could easily get hurt.

Suddenly a whistle blows. The machines stop, high spirits return. The workers run to the side of the room and pull out metal lunch buckets from under the benches there. They eat fast, talking and joking. In just a few minutes, the whistle blows again and they rush back to their machines.

Meanwhile, in the town nearby, it is also lunchtime. Office workers—men in derby hats and women in high-collared white blouses—come pouring out of the commercial buildings downtown.

No whistle announces their lunch break, but their time on the job is also rigidly scheduled. They have to get to work at a certain hour, eat at a certain hour, leave at a certain hour.

In fact, more and more Americans each year work according to schedules—and at a pace—set by someone else. They have lost control over the timing of their own lives.

Why?

The simplest explanation is that fewer and fewer people now work for themselves. Agricultural machinery and improved farming methods have made farmers a smaller fraction of the farm work force. Competition from low-priced factory goods has put large numbers of craftspeople out of business.

Many of these displaced workers have gone to work for others, often in factories. Their new employers are now the ones to tell them when to report to work.

This drop in self-employment helps explain who sets work-schedules. But it does not explain why these work-schedules are more rigid and rushed than before.

To learn more about this, stop here and read the sidebar on page 2. It describes how the growth of the factory system and of a national economy made co-ordination and precise timing very important. When you have read it, come back here and continue your visit.

The changes you just read about underline what you see in 1980s America. You are thinking about them as you notice one of the office workers pause in his walk. Sure enough, he takes a watch out of his pocket, and carefully checks it against the ornate street clock.

Two hundred years ago, you locked at farmers and craftspeople to get a sense of typical pace; 100 years ago, you locked at factory workers. Today, the best people to look at are probably workers in a large computerized office. . . . There is one, up on the 38th floor of that building. Take an elevator there: every 30th floor down, the computer operator works. If the repeatedly takes time to check his time, and more information—but less and less time to react to the information, whether they are at a fax machine, in front of a television, at a computer terminal, or in a military command post. There is constant pressure to make quick decisions and to turn transactions over fast.

This is what people are working with in work situations.

Communication is so rapid at the end of the 20th century that events on the other side of the world become part of the everyday experience. The flight from one continent to another takes only a few hours. In fact, more and more Americans each year work on timepieces to find out the time when you were very small, and also trained you to how important in your lives, and how often you have to pay attention to it. Was this true even when you were very little?

No. . . . Your parents probably taught you to tell time when you were small, and also trained you gradually to take more responsibility for figuring things out on your own. For example, you can have set a timer on the microwave and know that it will be done when it beeps. Or, if you like, you can set your own schedule at home. When you wake up in the morning, it will remind you to carry out this activity . . . which is to make a mark on the label whenever you check the time or are made aware of the time. Keep on doing this all day, from the moment you wake up until you are ready to go to bed. (Keep a handy pen.)

The day after the children have kept count this way, write down the time they were ready for their next meal. Have them figure out a class total (older kids could also figure out a class average).

As a timekeeper, you are likely to be either higher or lower than the true figure? (Probably considerably lower, since no doubt the kids will often forget to make a mark.) How accurate did their guesses turn out to be?
Some of the examples the children come up with will probably elicit discussion, since the categories are not all rigid. The same activity may seem to some children to belong in the first category, while to others it belongs in the second. For example, for some purposes, eating their meals may be at the exact same time every day, while others eat at varied times (or don’t eat together at all). Drawing the children’s attention to these kinds of differences is an important part of this activity. The students’ lives are scheduled in different ways and to different degrees. Encourage the children to think about these differences . . . and about what they personally prefer.

The more aware the children become of their options and preferences, the better prepared they will be to make future choices involving timing. These discussions of personal attitudes about timing will also make more real and meaningful the historical materials that the children are going to be dealing with in the next step of this Lesson Plan.

When the children have had plenty of time to explore scheduling, move on to pacing, the other aspect of timing mentioned earlier. On the chalkboard, write the headings Speedy Activities and Leisurely Activities. Explain that by speedy activities, you mean simple, fast-paced activities where there is pressure on the doer to be fast. Again, the categories are not rigid. Here are some examples:

- **Speedy Activities**: car races, video games, games of tag, television quiz shows, airplane travel, overnight mailers, fast-food restaurants, speed-skating, timed exams, drive-in bank tellers, automatic teller machines, auctions.

- **Leisurely Activities**: gardening, playing checkers, drawing, going to the zoo, figure skating, shopping in an open-air market, organizing a marketplace, ball games, beach games, playing a science fiction story or play, illustrated if they wish, on the chalkboard. Explain that by leisurely activity, you mean that the doer is not under pressure to be fast. There are no fixed timing expectations. Timed exams, for example, are not usually considered leisurely activities.

Follow the same procedure for the two remaining word-pictures. Finally, have the children, as homework, carry out the Pull-Out Page activity.

### Step 4: When time-keeping stops

As a last step, have each of the children write a science fiction story or play, illustrated if they wish, on the following subject:

An Anti-Timekeeping Ray from outer space suddenly destroys all the time-keeping devices in the world. All the clocks and watches stop working. Metronomes won’t tick. When you dial the telephone time number, you hear a voice repeating “I don’t know . . . I don’t know . . .

Nothing else in the world has been damaged. All other things and people are fine.

Continue telling the story from here. What are some of the things that people notice first after the Ray strikes? What happens next? How do they react? How do they try to cope with the changes?

You may want to include an interview with someone 30 years after the Anti-Timekeeping Ray destruction. How do they view this event now? Looking back, do they think the effects were all bad . . . or were there good results too? If so, what?

### Real Things!

The Smithsonian’s National Museum of American History, in Washington, D.C., is full of objects related to the changes you have been reading about.

- **Highlights from the museum’s large collection of timepieces are on display in the Hall of Timekeeping and Light Machinery.**

If you can’t come in person to view them, you may enjoy the pictures and descriptions of them in American Clocks, by Otto Mayr and Carlene Stephens. This 52-page book, published in 1990, may be ordered by writing: Publications Division, Room MB866, NMAH, Smithsonian Institution, Washington, DC 20560. A check for $8.95, payable to “Smithsonian Institution,” should accompany your order.

- **See more . . . learn more . . . about the speeding-up of our ability to process and communicate information . . . at the largest interactive exhibition ever mounted at the Smithsonian—Information Age: People, Information & Technology.** The exhibition places this evolution in a social context, showing how information technologies have changed our lives.

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**Resource Guide for Teachers**

This 90-page guide describes over 300 resources available from the Smithsonian. More than half of these resources are free or are available for a nominal fee. You’ll find posters, recordings, newsletters, bibliographies, books and brochures, kits, and video programs to use in your classroom. Send a check for $4.95 to Smithsonian Institution/OESE, Department 0561, Washington, D.C. 20073-0561.

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**Bibliography**

Books for teachers


Books for children


Time Machines

All the pictures on this page show inventions that have affected the timing of people's lives. The caption under each picture tells you what it is. Imagine now that each of these inventions can talk and describes itself. Their statements appear at the right of this page.

Your job is to figure out which invention made which statement and to draw a line connecting them. Then find or draw pictures of two other Time Machines, of your own choosing. How would they describe themselves?

Train. "There he hung for his life, the train sweeping along at frightful velocity..." say the words under this picture, which was the cover of a 1900 boy's magazine.

Typewriter. Office worker with her shorthand pad and typewriter, ready to turn out written words quickly.

Automobile. This one is a 1926 Model T Ford roadster.

Airplane. Douglas DST (Douglas Sleeper Transport), developed to provide comfort as well as speed on the long trip across the country. During the day, passengers sat in seats, as they do on most passenger planes. But at night, as the inset shows, these seats could be converted into bunk-type beds. This airplane went into service in 1936.

Radio. Yes,

Computer. This picture is part of a first all-purpose, word-and-numeral processing machine. The same procedure.

Television. The inset shows a Civil War, the telegrapher.

Birth of the Telephone.
What Am I?

- I made it possible for people in different parts of the country to hear the same news, music, and plays at the same time... bringing Americans into a shared present moment.
- Once they began to mass produce me cheaply, I made it possible for everyone to check the time whenever they wanted... and to be on time.
- I gave individuals a way to travel quickly wherever they wanted, around a city or over long distances, even on the spur of the moment. I became so important that I transformed the country.
- I made one kitchen task faster.
- Thanks to me, people and freight could travel long distances much faster than before... and factories could sell what they made to buyers all over the country.
- I kept faster, more dependable track of cash exchanges than had been possible before.
- I began helping people process information faster... and my descendants are continuing to do the same job... and many others. They can process a lot more information than I could, a lot faster... and they are smaller!
- Once I became common, one person could talk directly with another—even if they were hundreds of miles apart. At first I was used in business, but I soon moved into people's homes too.
- I've been around commercially since just after World War I, carrying people long distances in fantastically short times. I'm now the most common way to travel when people don't drive.
- I speeded up written communication.
- I'm an unusual-looking member of my family... but all kinds of us became popular in the late 1800s. We gave our users a wonderful sense of freedom of movement and speed, and our popularity led to a demand for better roads.
- I was the first device that could carry messages instantly over long distances, though these messages had to be put into a code. Though the picture shows me doing something else, I'm particularly famous for making it possible to coordinate the movements of trains in large railroad systems.
Maquinas de Tiempo

Todas las figuras en esta página muestran inventos que han afectado la regulación del tiempo en la vida de la gente. La leyenda debajo de cada figura te dice lo que ésta es.

Imagina ahora que cada uno de estos inventos puede hablar y se describe a sí mismo. Sus descripciones aparecen al lado derecho de esta página.

Tu trabajo es descifrar cuál invento originó cuál descripción y dibujar una línea de conexión entre los dos... Luego busca dibujar figuras de otras dos máquinas de tiempo que te gusten. ¿Cómo se describirían ellas mismas?

Tren. “Se colgó allí para salvar su vida, el tren desplazándose a una velocidad espantosa” dice la leyenda de esta figura, la cual fue la cubierta de una revista para niños en 1900.

Máquina de escribir. Oficiosa con su libreta de taquigrafía y máquina de escribir, lista para producir palabras escritas rápidamente.


Radio. Si, el radio, uno de los primeros dispositivos que recibieron el nombre de “telegrafia”.

Computadora. Figura forma parte de la primera máquina del software, de uso múltiple. Hoy, un computador puede hacer más cosas que la mayoría de los humanos juntos.

Teléfono. Del 1900 a la rapidez de la información.
Bicicleta. En realidad, este vehículo de 1880 no es técnicamente una bicicleta, puesto que tiene cuatro ruedas en vez de dos. Aunque su construcción lo hace un pariente muy cercano. El edificio en el fondo es la Casa Blanca.

Caja registradora. Este modelo decorado fue hecho por la Compañía Nacional de Cajas Registradoras en 1919.

¿Qué Soy Yo?

- Hice posible que gente en diferentes partes del país pudieran oír las mismas noticias, música y obras de teatro al mismo tiempo, haciendo posible que los norteamericanos compartieran el mismo momento.
- Una vez que empezaron a producirse en masa a bajo costo, hice posible que cada persona pudiera constatar la hora cada vez que quería y ser puntual.
- Le di a los individuos una manera de viajar rápidamente además quisieran, alrededor de una ciudad o largas distancias, incluso en el momento en que ellos lo deseaban. Me hice tan importante que transformé el país.
- Hice de una de las tareas de la cocina más rápida.
- Gracias a mí, la gente y la carga podían viajar largas distancias más rápidamente que antes y las fábricas pudieron vender a los compradores lo que hacían en todo el país.
- Mantuve un registro más rápido y más eficiente del intercambio de dinero efectivo de lo que había sido posible anteriormente.
- Empecé ayudando a la gente a procesar información más rápido y mis descendientes continúan haciendo el mismo trabajo y muchos otros. Pueden procesar más información que la que yo pude, mucho más rápidamente y seguramente son ¡más pequeños!
- Una vez que me hice común, una persona podía hablar directamente con otra, ambas oyendo sus voces aun cuando estuvieran separadas cientos de millas. Al principio fue solo usado en los negocios, pero pronto me mudé también a los hogares.
- He estado comercialmente en uso justo desde la Primera Guerra Mundial, transportando a la gente en largas distancias en tiempos fantásticamente cortos. Soy ahora la forma más común para viajar cuando la gente no conduce.
- Aceleré la comunicación escrita.
- Soy un miembro poco común de mi familia, pero modelos de todo tipo nos hicieron populares a finales de 1880. Le dimos a nuestros usuarios un sentido maravilloso de libertad de movimiento y velocidad, y nuestra popularidad condujo a la demanda de mejores vías.
- Fui el primer equipo que pudo llevar mensajes instantáneamente a través de largas distancias, aunque estos mensajes tenían que estar en un código. Aunque la figura me muestra haciendo otra cosa, soy particularmente famoso por hacer posible los movimientos de los trenes en los sistemas ferroviarios grandes.