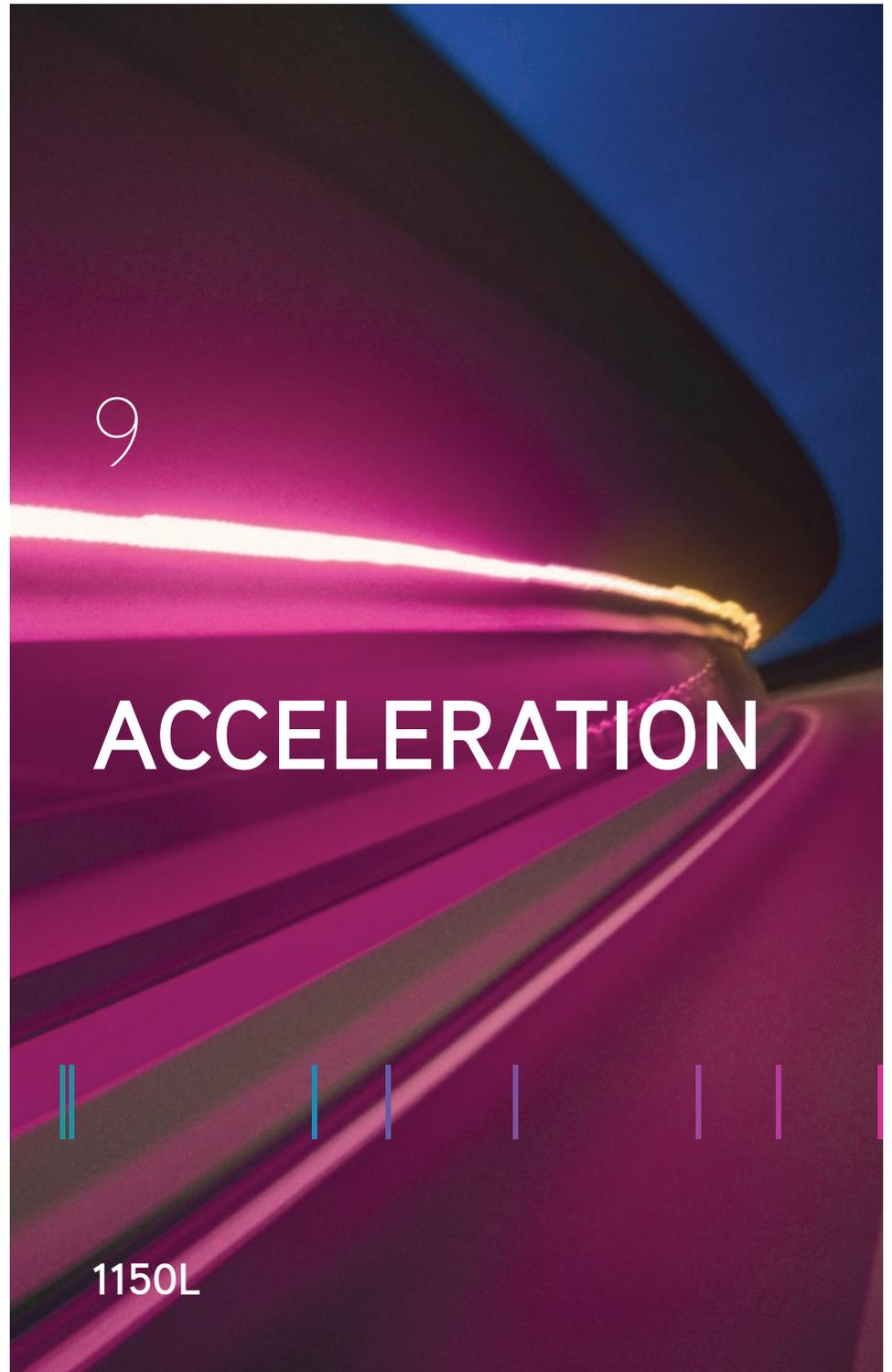


9

# ACCELERATION

1150L

BIG HISTORY PROJECT





# ACCELERATION

A HISTORIAN REFLECTS  
ON A LIFETIME OF CHANGE

By Cynthia Stokes Brown

Acceleration, an increase in the rate of change, is occurring both in the Universe and in human culture on planet Earth.

## Definitions

In 2011, three astronomers were awarded the Nobel Prize in Physics for discovering in 1998 that the expansion of our Universe is accelerating, rather than decelerating as they had expected. They found that the galaxies farthest away from our Milky Way galaxy are flying away from us faster than the galaxies nearer to us. The astronomers discovered this by charting changes in the distances of far galaxies, which they measured by observing supernovae that exploded in them. This means simply that the expansion of our Universe is happening at a faster and faster rate. That is, it is accelerating.

Apparently this accelerating expansion of our Universe has not always been the case. It seems to have started about 5 billion years ago, about the same time that our Solar System began. No one knows what anti-gravity force can be pushing the farthest galaxies away faster and faster. Astronomers are calling this unknown force “dark energy” and are estimating that it fills about 70 percent of space. Stay tuned as astronomers learn more about this.

Here on Earth, a different kind of acceleration is happening. For humans, acceleration means that the rate and scale of cultural change is increasing. David Christian wrote in his book *Maps of Time* that it might not be an exaggeration to claim that “more change has occurred in the twentieth century than in all earlier periods of human history.”

## Evidence for acceleration

What do we mean when we say that the rate and scale of cultural change are increasing? What evidence do we have? How can we measure change? On the cosmological or geological scale, change is measured in millions or billions of years. On the biological scale, with natural selection setting the pace, change occurs in thousands to millions of years. On the scale of human culture, large-scale change used to occur over millennia or centuries, but now it is taking place in decades or even years.



Let's look at the length of time that each of the major periods of human history has lasted. The Paleolithic era, or the era of hunting and gathering, lasted from the beginning of our species about 250,000 years ago to about 10,000 years ago. That's about 240,000 years, or 240 millennia. The period of agriculture lasted about 10,000 years, or 10 millennia, while the modern industrial era has lasted 200 years, or one-fifth of a millennium. Do you see a pattern of accelerating change? Each era lasted for a much shorter period of time than the earlier one. Now we seem already to be near the beginning of a new era, since we cannot continue long in our present mode: oil is running out, and the burning of fossil fuels is changing our climate.

Zooming in on the twentieth century, we might begin by looking at the increase of human population. In 1900, the Earth had 1.6 billion people; in 1950, it had 2.5 billion; and in 2000, it had 6.1 billion. In other words, it just about doubled twice in one century. In the lifetime of anyone who lived through the last half of the twentieth century, the human population doubled in 40 years. This has never happened before in anyone's lifetime. Since 2000, the rate of population growth has slowed somewhat, but the human population has still increased to 7 billion. This total represents an enormous, rapid, and unprecedented change for humans and for the planet.

The number of people who have ever lived is estimated to be about 80 billion. Of those, 20 percent have lived in the modern era. About 8 percent (7 billion divided by 80 billion) of all humans who have walked the Earth are alive today.

What has made it possible for so many people to survive and live a long life? (Average worldwide life expectancy has risen from about 35 years in 1900 to about 66 years in 2000.) The answer seems to lie in the increased interplay of energy flowing through human systems and increasing innovations in human technology.

The force that propels the acceleration of change in human societies today is the burning of fossil fuels — coal, oil, and natural gas — and the technological innovations of the modern era. Oil came into use in the early twentieth century, revolutionizing transportation by fueling cars, trucks, tractors, airplanes, and tanks. During the twentieth century, energy use in the world expanded thirteenfold, which included oil production soaring sixfold just from 1950 to 1973. The three fossil fuels provide energy that originated from the Sun and was sent to Earth millions of years ago, supporting early life forms, preserved somewhat in their remains and then retained underground or under the sea until humans retrieve it. This extra energy propels our food production and our technologies (transportation, communications, financial systems, space exploration, and military actions). Our global civilization is based on fossil fuels at the present time. As of 2010, only about 16 percent of global energy comes from renewable sources.

More people and more energy from fossil fuels have added up to a great increase in the size of the global economy — a tenfold increase since the end of World War II in 1945. The period since then is sometimes called the “Great Acceleration,” because global increases in population, production, and energy use have increased at a previously unknown rate.

## Technology over three generations

The changes in technology that occurred in the twentieth century may be more vivid if I compare some aspects of the life of my grandmother, Bertha Mantz Bast, who lived from 1888 to 1987, with aspects of mine.

My grandmother married my grandfather, Paul Jacob Bast, in 1909. They lived with his parents on a dairy farm in southern Wisconsin, 20 miles from Milwaukee. At that time, Grandpa already had his first Ford tractor, but they had no electricity, car, radio, or telephone. They traveled only as far as they could walk, or as far as horses could pull a sleigh in winter or a buggy in summer. On special occasions, they might take a train. They milked the cows by hand and pumped water into the kitchen by hand. Grandma hung the laundry on lines to dry, and grew their vegetables in her gardens. The farm had kerosene lamps, wood stoves for cooking and heating, and a privy (toilet) outside. Everyone bathed in the kitchen in a large wooden tub. Grandma said they were clean and happy.

During Grandma’s life on the farm — until they moved to a city in 1954 — innovations appeared that changed her life immensely. Sometime before 1920, Grandpa bought his first car, a Model-T Ford that had to be hand-cranked to start the engine. (Grandma never learned to drive.) Electricity arrived in 1921, ending the kerosene lamps. Soon there was indoor plumbing, hoses to water the garden, and eventually milking and washing machines, plus radios, telephones, and phonographs. In her 80s, Grandma flew on an airplane twice to visit her daughter, who lived in San Salvador, El Salvador.

In my lifetime, technological innovations have appeared even faster. Before I married in 1961, antibiotics had come into use to help fight illnesses, color television (1940) had been invented, as well as atomic energy (1945) and credit cards (1950). After my marriage, the first man landed on the Moon in 1969, the first IBM PCs appeared in 1981, and the first Apple Macintoshes in 1984.



After that, the list accelerates even more:

- 1990 World Wide Web
- 1991 First hydrogen fuel cell for automobiles
- 1992 Digital cell phones
- 1995 DVDs
- 1997 Toyota hybrid car released in Japan
- 1998 High-definition television
- 2000 Nano-Tex fabrics
- 2001 New artificial heart and liver technology; iPods
- 2004 Facebook
- 2005 YouTube
- 2007 New record of efficiency in solar cells
- 2010 First iPad

Now in my later years, I am much more hopelessly out of date than my grandmother ever was. I have a much harder time keeping up with the innovations that keep appearing because the pace of change has accelerated. Yet the payoff for me has been staggeringly wonderful. Now I can connect almost instantaneously with anyone in the world, and with all the knowledge in the world. I can jump in a plane and be anywhere within hours. I can finish the maintenance work of my daily life in very little time. Grandma would hardly be able to believe it, and she's been gone only 25 years.

In these paragraphs, I have described only innovations as they have affected daily life. But technology has transformed all areas of human life. Today human activity is connected in a simultaneous global network never before attained on Earth — an exchange network that includes medicines, foods, and weapons. What will the pace of change be like during your lifetime?

## Sources

Bellis, Mary. "Famous Inventions: A to Z." About.com. Accessed December 7, 2011.  
<http://inventors.about.com/od/astartinventions/a/FamousInventhin.htm>.

Brown, Cynthia Stokes. *A History of the Mantz and Bast Families*. Self-Published, 2003.

Christian, David. *Maps of Time: An Introduction to Big History*. Berkeley, CA: University of California Press, 2004.

McNeill, J.R. *Something New Under the Sun: An Environmental History of the Twentieth-Century World*. New York: W.W. Norton, 2001.

## Image credits

Highway with car lights  
© Pete Leonard/CORBIS

NGC 281 or the "Pacman Nebula,"  
X-ray: NASA/CXC/CfA/S.Wolk; IR: NASA/JPL/CfA/S.Wolk

Elevated roadways in Shanghai, China  
© Joachim Ladefoged/VII/CORBIS

## NEWSELA

Articles leveled by Newsela have been adjusted along several dimensions of text complexity including sentence structure, vocabulary and organization. The number followed by L indicates the Lexile measure of the article. For more information on Lexile measures and how they correspond to grade levels: <http://www.lexile.com/about-lexile/lexile-overview/>

To learn more about Newsela, visit [www.newsela.com/about](http://www.newsela.com/about).



### **The Lexile® Framework for Reading**

The Lexile® Framework for Reading evaluates reading ability and text complexity on the same developmental scale. Unlike other measurement systems, the Lexile Framework determines reading ability based on actual assessments, rather than generalized age or grade levels. Recognized as the standard for matching readers with texts, tens of millions of students worldwide receive a Lexile measure that helps them find targeted readings from the more than 100 million articles, books and websites that have been measured. Lexile measures connect learners of all ages with resources at the right level of challenge and monitors their progress toward state and national proficiency standards. More information about the Lexile® Framework can be found at [www.Lexile.com](http://www.Lexile.com).