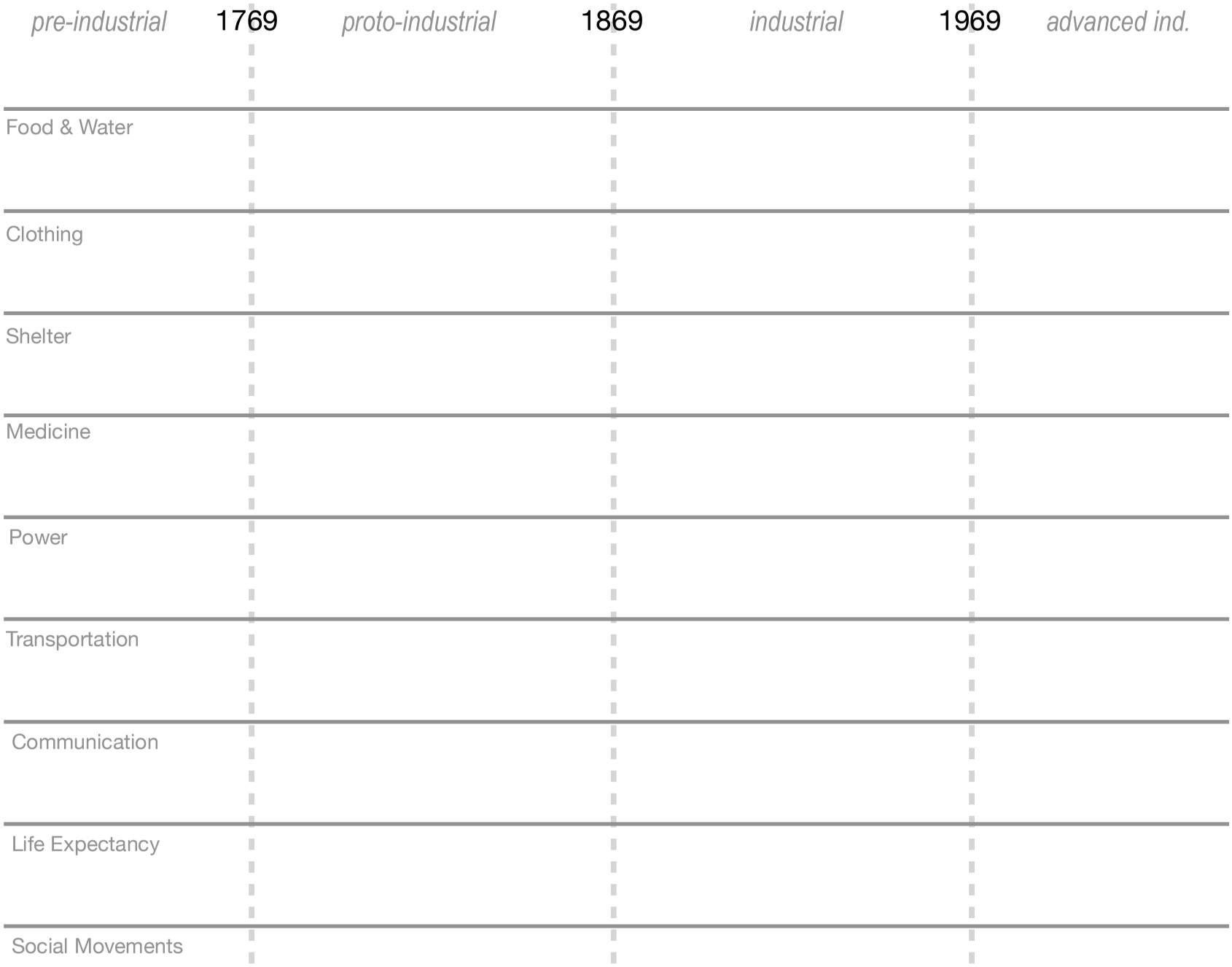
TECHNOLOGY AND SOCIETY

A. Material Inventions and Their Impact on Human Life

1. Human beings have material and non-material needs. The fundamental values we need in order to sustain our physical existence are: food, water, clothing, shelter, and medicine. Among the key non-material/spiritual values we need are love, friendship, inspiration, and self-esteem.
2. When we study technology (which consists of material inventions) as part of history, it is primarily the material outcomes that we are focused on, and only on a certain scale. The goal is to understand how technological innovation affects *society*—which in this context means organized human life on a scale that affects the course of history.
3. In addition to the technologies directly involved in the production of food, shelter, and other physical values that allow human beings to live, many technologies indirectly contribute to our production and distribution of these values, and thus to humans' ability to thrive on Earth. Communication and transportation technology are especially important. (As a simple example, imagine a 911 call, and the ambulance that comes because of it, which combination of communication and transportation are often necessary in order to bring a person in need to the medicine, i.e. medical *technology*, that can save them.)
4. One thing that most of our technologies have in common is the need for some kind of *power*. That by itself is a dimension of the story that deserves special attention. The modern Internet and all the devices that tap into it obviously need electricity. The vast majority of vehicles need some kind of fossil fuel to propel them.
5. As we will see, the proliferation of technology in modern history has at least *doubled*, if not *tripled*, the average human life span, and vastly improved the *quality* as well as the *quantity* of life.
6. That said, technological advancement comes at a cost, and with various challenges, from things like negative lifestyle changes (sitting too much, and not getting enough exercise) to overeating (because of the superabundance of food, especially processed food) to wider—even global—impacts, such as of pollution.
7. Not surprisingly, even though technology has been widely embraced because of its life-serving power, people have also responded to the costs and challenges of technological adoption in various ways, including by the outright rejection of technology in various regards. (Some people reject vaccines because they view them as unsafe; others ride bicycles to work instead of driving; parents place "screen time" limits on their kids; most people recycle various products; and people generally strive to be "environmentally conscious," even to the point of advocating de- or anti- industrialization.)
8. The obvious, positive impact of technology on human life, and the social responses to both the positives and negatives will be focus of this segment of the course.

B. Organizing the Story

1. Since the story of technology proceeds on its own trajectory and somewhat independently of politics or other aspects of history, and also because it involves so many related fields of innovation, we need a new kind of timeline to capture the story.
2. The timeline we will use, available on the next page, will divide the story into four periods, or chapters: *pre-industrial, proto-industrial, industrial,* and *advanced industrial.*
3. This periodization scheme, which means a method of dividing the story into periods so that they function as a framework for understanding the world we live in, is based on the creation of certain distinctive technologies that have produced clear advances in human life. The milestones have been indicated in class and will be explained further in the notes.

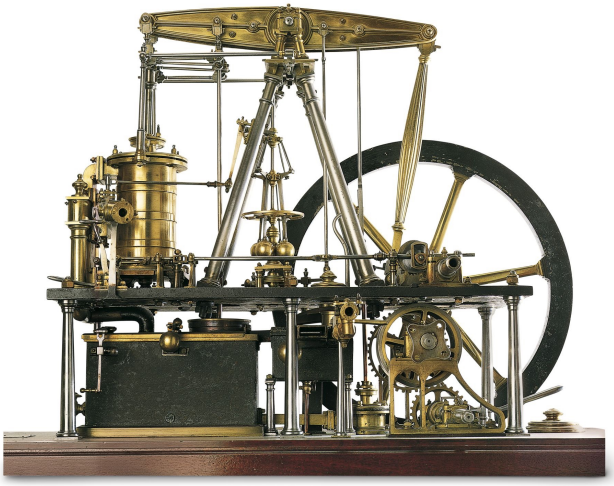

pre-industrial
1769
proto-industrial
1869
industrial
1969
advanced ind.
Food & Water
Clothing
Shelter
Medicine
Power
Transportation
Communication
Life Expectancy
Social Movements

C. Pre-Industrial Life (- c.1769)

1. Pre-industrial life, which is to say, the stage of civilization prior to **c.1769**, is a long era during which human beings did not possess any of the advanced technology we have today, and life was consequently much simpler and moved at a slower pace.
2. The vast majority of human energy was directed towards agriculture. The so-called "Agricultural Revolution" occurred some time before **3000 BC**, leading early civilizations to become fixed in place and focused on producing crops and domesticating certain types of animals.
3. This permitted just enough of an improvement in the standard of living of our ancestors to give them the spare time to spend on such things as the invention of writing, and thus the recording of history.
4. Amazingly, little beyond the creation of agriculture was accomplished to further material life for the next 5000 years. The pre-industrial era is an era of stagnation on the plateau of *subsistence*.
5. To the best of our ability to reckon the data, modern estimates of life expectancy for human beings worldwide until industrial times was about 25 years. (This is, of course, an average. Some lucky and hardy individuals lived perhaps as long as we do today. By far more people died as babies, infants, children, and young adults from famine, malnutrition, disease, and war.)

D. The Watt Steam Engine (c.1769)

1. The discovery of America by Christopher Columbus in **1492** was made possible by a rebirth of the science of geography after the long European Dark Ages.
2. Other similar revivals took place in many sciences, and new knowledge began to proliferate as a "scientific revolution" took place in modern Europe.
3. Probably the most famous example of this revolution was the creation of the "heliocentric" theory of the universe by Nicolas Copernicus, displacing the previous theory of astronomy that had the Earth in the center (the "geocentric" theory).
4. As science began to progress rapidly, especially in the 1600s, the practical application of scientific knowledge to produce new forms of technology also accelerated.



An early working model of the Watt Steam Engine. Large stationary engines like this were used in mining to raise large amounts of ore, run escalators for workers, pump water, and later to move very large vehicles.

5. By far the most important of these technological advances was the Steam Engine of James Watt, invented **c.1769.**
   a) A steam engine is based on the sciences of physics and chemistry, and specifically the field of thermodynamics, which studies physical matter and energy.
   b) As anyone can observe, when you boil a pot of water with a lid on it, the steam forces the lid to jump as its escapes.
   c) Thermodynamics explains how and why water vapor creates this pressure.

d) If one can create a vessel where water is heated to produce vapor and the pressure created by that vapor is captured as a mechanical force, one can produce an *engine.*
e) Various precursors to the Watt steam engine had been developed around Europe in the century leading up to his model, but none were sufficiently efficient to produce power in a way that could transform human industry.
f) It was by examining a prior engine, made by another engineer named Thomas Newcomen, that James Watt was able to create his breakthrough design, the *Watt* Steam Engine **c.1769.**
g) Because the process of invention is usually long and arduous, it is often difficult to assign a precise date to an invention. Does one choose the first moment when an inventor had the basic idea? Does one choose the time when his first prototype is created? Or is it the first production model? Or the year when (and if) he is able to obtain a patent (official recognition)? It is sometimes impossible to assign a single year, let alone a date, to an invention. For that reason, we will designate the invention of the Watt Steam Engine as occurring **c. ("circa") 1769.**