The profession of engineering has progressed from a trade relying heavily on prior experience and practical knowledge to a science that rigorously employs math and scientific theories to solve detailed problems. In ancient times, empires sought ambitious engineering projects, such as the Pantheon in ancient Rome or the Persians’ bridge of boats from Asia to Europe. These civilizations did not have the detailed mathematical knowledge needed to analyze their designs. However, they were still able to construct impressive and durable feats of engineering simply through their own experience. These ancient engineers relied mainly on prior engineering achievements, such as simpler arches and smaller bridges, in order to construct the large projects that are remembered by history.

Even when engineers introduced new innovations, such as the flying buttress and barrel vault used in gothic-style cathedrals, they were primarily building upon prior experience. The barrel vault, for instance, was an extension of the simple arch. The dome, such as was used in the pantheon hundreds of years earlier, showed that the arch could be continuously rotated 180 degrees to create an enclosed space that was both spacious and sturdy. The barrel vault used a similar concept and, rather than rotating the arch, extended it laterally to form a long room. Early barrel vaults were used in small hallways, but as builders gained more experience with them—and thanks to the reinforcing flying buttress—they eventually were used in cathedrals that had unprecedented amounts of open space inside. Engineering still relied on trial and prior experience to prove the workability of concepts.

In the 18th and 19th Centuries, capitalistic economies pioneered by the Dutch—which included investment markets and free trade—encouraged entrepreneurship and led to new inventions that were not merely small additions to prior feats. Rather, these technologies largely sprung out of scientific discoveries. One example of such technologies is the steam locomotive. Many different engine designs were patented and many of these came from inventors who had prior experience studying thermo-fluid mechanics. These men began to utilize scientific knowledge to inform their designs. However, they were not yet to the point of the modern engineer who would fully analyze the system prior to construction. Rather, they used a combination of scientific theory and experience to gain an intuitive understanding of their systems which they used to inform their designs.

The study of radar in the early 20th Century ushered in a new era for engineering that was heavily based on understanding scientific theory. Radar was a completely new concept for engineers and the small-wavelengths of electromagnetic radiation that it used had only been studied by physicists. As a result, the British efforts to develop radar as a military technology relied heavily on physicists to conduct research as well as to implement the physical systems. A similar transition happened in other fields as technology became more advanced and specialized. Engineers now needed to thoroughly utilize theoretical scientific knowledge.

While I find myself at the end of this progression, in an era of modern engineering heavily dependent on theory, I think this class has helped me understand that engineering has not always been about, and perhaps will not forever continue to be about, a detailed analytic understanding based on science and math. Rather it has largely relied on experience in the past, and I should not forget about the value of experience in my own lifetime.

Atomic energy impacted the United States socially, culturally, and politically. Politically, it ushered in a new era of government investment and regulation. The huge amounts of spending by the military on the factories in Indiana and Washington used to enrich Uranium and Plutonium for the original atomic bombs were a predecessor to the era of massive spending by the military in scientific and engineering research during the cold war. Eisenhower’s Atoms for Peace initiative introduced a new cultural narrative of using the same technology that made the bomb for civilian power generation. The initiative received tremendous praise from around the world at first, a created vast optimism about the future of atomic energy. The public looked forward to a fantasy of electricity that would be safe, clean, and cheap.

Gothic cathedrals were a defining technology for European city states. Technologies such as the barrel vault and flying buttress allowed cathedrals to be built bigger than ever before and affected cities both politically and culturally. The cathedrals were built to be spacious and open, featuring large rooms and walls consisting of huge stained-glass windows. These architectural aspects were meant to point people towards God and encouraged a religious culture. Socially, they reinforced the authority of the church, demonstrating its ability to build massive structures that would have been seen as impossible a few centuries earlier. Politically, the cathedrals supported the local city. The political importance of cathedrals is shown by how neighboring cities would compete to build the largest cathedral.