APPENDIX A

History in the Making: The Industrial Revolution to the Maker Movement

Pre-1700's

Prior to the first industrial revolution, manufacturing of goods was done at small scales in what is referred to as a cottage industry. Locally produced items were made by craftspeople, usually in their own homes or shops connected to their living spaces. (The Editors of Encyclopedia Britannica, 2018)
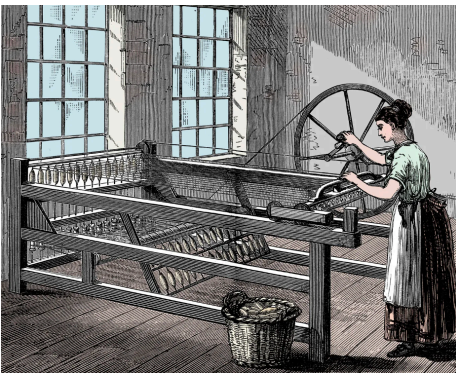

image source: https://www.britannica.com/biography/James-Hargreaves

The late 1700's

The first industrial revolution saw inventions like the spinning jenny and the steam engine. The first steam engine was designed and built in the United States, by Oliver Evans, of Philadelphia, Pa., 1801, and the spinning jenny was invented by James Hargreaves in 1770. (The Editors of Encyclopedia Britannica, 2018)

1812

Tabitha Babbitt invented the circular saw in 1812, which helped to improve lumber production and became a critical tool in the American Industrial Revolution. According to the Shakers, Babbitt was watching men use the difficult two-man whipsaw when she noticed that half of their motion was wasted. She proposed creating a round blade to increase efficiency. (Barrett, 2020)

image source: https://buscafriends.com/it/interests/post/12911

1843

Ada Lovelace translated a French paper about the Analytical Engine and published how it could perform a sequence of calculations, the first computer program. Ada is considered the first computer programmer. Even though she wrote about a computer that was never built, she realized that the computer could follow a series of simple instructions, a program, to perform a complex calculation. (Whitfield, 2017)
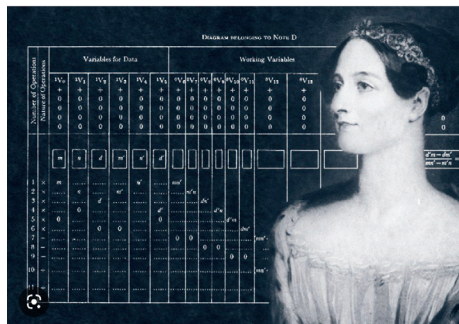

image source: https://www.lookfar.com/blog/2017/10/14/ada-lovelace-awards-backstory/

1855

The first U.S. Mechanics' Institute of San Francisco was organized for "the diffusion of knowledge at the least expense to the seeker." Mechanics' Institutes in general were the offspring of the industrial revolution. They were created in Scotland in the 1820's with the objective of providing technical education to those for whom a traditional university experience was unattainable. (Blei, 2016)

image source: https://lithub.com/the-library-the-gold-rush-built/

1870 – 1914

The second industrial revolution resulted in factories joining with steam-powered ships and railroads. In the 1860s, steel and metal goods were being produced in large quantities, and the assembly line was created. At-home and small-space inventors, hackers, and makers emerge with wondrous creations, pushing technology and industrial production forward. (Mokyr & Strotz, 1998)
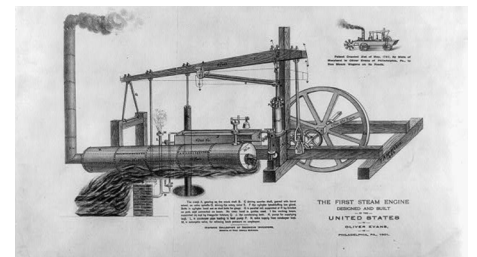

image source: McKibbin, Thomas Arnold. (1893). The first steam engine designed and built in the United States, by Oliver Evans, of Philadelphia, Pa., 1801. Retrieved from https://library-artstor-org.ezproxy2.library.drexel.edu/asset/LOCEON_1039797703

1876

After he sold the rights to the quadraplex telegraph to Western Union, Thomas Edison used the proceeds to establish a research lab — what he would soon call his "invention factory" — in Menlo Park, New Jersey. (Smithsonian Lemelson Center, 2010)

image source: Byron Company (New York, N.Y.). (1920). Thomas Edison.. Retrieved from https://library-artstor-org.ezproxy2.library.drexel.edu/asset/AMCNYIG_10313500908

1877

1877, in Washington, D.C., after winning the Volta Prize for the invention of the telephone, Alexander Bell started the Volta Laboratory, which would later inspire the creation of the storied Bell Labs. The Volta Laboratory was for the research and development of telecommunication, phonograph and other technologies. (Volta Laboratory and Bureau, 2023)
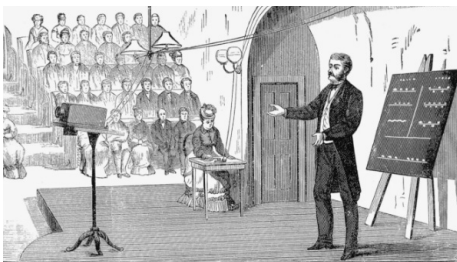

image source: https://www.britannica.com/biography/Alexander-Graham-Bell/images-videos

1879

While factory jobs of the Industrial Revolution improved livelihoods, smokestacks billowed thick plumes of smoke into the air. Mary Walton owned a boarding house in New York City situated directly next to the elevated railway. Disgusted by the black smoke and roar of the train engines, Walton decided to solve the problems herself. Walton's invention (patent #221,880) deflected the emissions being produced from smokestacks into water tanks, where they were stored until they were flushed in the city sewage system. (Massachusetts Institute of Technology, n.d.)

image source: https://lemelson.mit.edu/resources/mary-walton
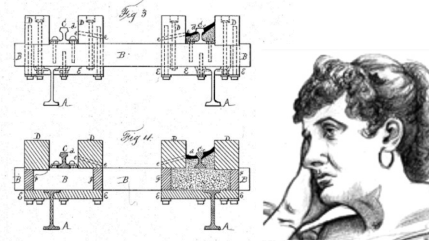
1908

Henry Ford of the Ford Motor Company introduced the Model T. At first, Ford built only a few cars a day. Because demand for Model Ts was so high, Ford developed a way to make more of them without increasing cost. In 1913, he rolled out a moving assembly line. (Delbanco, 2019)

image source: (1908). Ford: Model T. Retrieved from https://library-artstor-org.ezproxy2.library.drexel.edu/asset/ARTSTOR_103_41822001081056

1940

The earliest known U.S. "makerspace" for community-use in San Fransisco opens. The space is mentioned in the 1940 publication of Popular Mechanics magazine. The community workshop rented tools and space to craftsman, in addition to a large library and staff to offer expert advice to members. (Holman, 2015)

image source: Popular Mechanics, 1940.

1942

The pre-cursor to bluetooth was developed by Hedy Lamarr with the American composer George Antheil as a "secret communications system". By manipulating radio frequencies at irregular intervals between transmission and reception, the invention formed an unbreakable code that could prevent secret messages from being intercepted. In parallel with her Hollywood fame, Hedy Lamarr was a constant tinkerer and successful inventor who contributed significant innovative engineering ideas adopted by the U.S. military and consumer industries. (Levins, 2018)
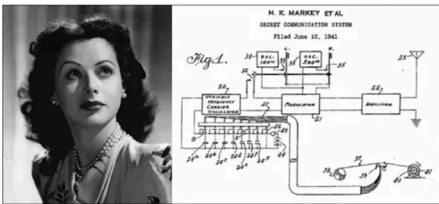

image source: https://wednesdayswomen. com/hedy-lamarr-serious-inventor- trapped-in-a-hollywood-image/

1950's

The Information Age started around 1950 and continued through the 1990s, beginning with the personal computer and evolving to include the Internet and World Wide Web. (Anderson, 2012)
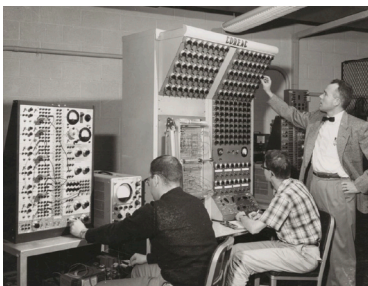

image source: (1960). Electronic Analog Computer. [black-and- white, photographs]. Retrieved from https://library-artstor-org. ezproxy2.library.drexel.edu/asset/ SS35197_35197_19449877

1970's

This was a time of economic upheaval caused by the rise of higher education, geopolitical conflict and globalization starting the U.S. shift to a service economy. Since the 1970s the American economy has moved away from producing goods to providing services, and the service- producing sector has accounted for an increasing proportion of workers. Two recessions during the early 1970s saw manufacturing lose 1.5 million and 2 million jobs. Off- shoring of labor and manufaturing starts to rise. (Johnston , 2012)
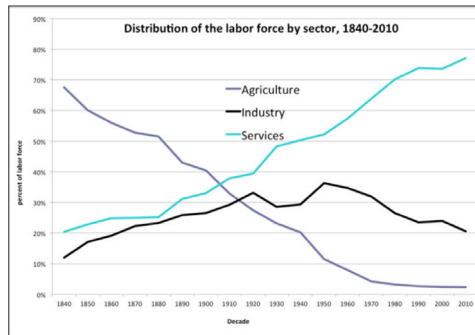

image source: https://www.bls.gov/

1980's

In the new service economy, people have more time to spend at home persuing hobbies. This decade saw a rise in at-home makers, tinkerers, and craftspeople, especially women. (Anderson , 2012)

1981

The earliest 3D printer originated in 1981, when Dr. Hideo Kodama invented one of the first rapid prototyping machines that created parts layer by layer, using a resin that could be polymerized by UV light. (BCN3D, 2020)

image source: https://3dprint. com/72171/first-3d-printer-chuck-hull/

1983

January 1, 1983 is considered the official birthday of the Internet. Prior to this, the various computer networks did not have a standard way to communicate with each other. A new communications protocol was established called Transfer Control Protocol/ Internetwork Protocol (TCP/ IP). (CERN, n.d.)

image source: https://home.web.cern.ch/ science/computing/birth-web

1993

The world wide web goes public on April 30, 1993. Four years after publishing a proposal for "an idea of linked information systems," computer scientist Tim Berners-Lee released the source code for the world's first web browser and editor while working at CERN. The web was originally conceived to meet the demand for automated information-sharing between scientists in universities around the world. (CERN, n.d.)

image source: https://home.web.cern.ch/science/computing/birth-web

1995

According to HackerspaceWiki, 'c-base' in berlin is "one of the first globally known hackerspaces." c-base e.V. is a non-profit association located in Berlin, Germany. Its purpose is to increase knowledge and skills pertaining to computer software, hardware and data networks. Seventeen people founded c-base e. V. in the autumn of 1995. (HackerspaceWiki, 2022)
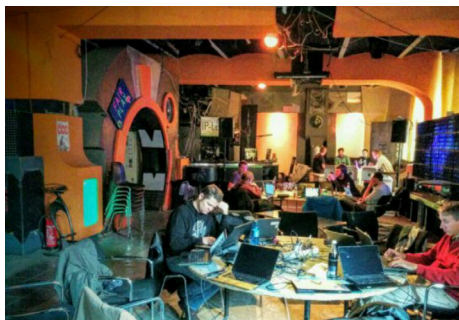

image source: https://wiki.hackerspaces.org/c-base

2001

The Center for Bits and Atoms (CBA) is established in the MIT Media Lab at the Massachusetts Institute of Technology. The CBA is an interdisciplinary initiative exploring the boundary between computer science and physical science, currently run by Neil Gershenfeld. (Center for Bits and Atoms, n.d.)

image source: cba.mit.edu

2002

Neil Gershenfeld, a professor at MIT's Media Lab, has the idea to create affordable fabrication labs, launching the 'FabLab' initiative. He believed that one day every home would have their own personal fabrication device. (Karagianis, 2006)

2005

Make magazine is a print and online publication focused on DIY projects, maker culture, and technology. The magazine was founded in 2005 by Dale Dougherty and Sherry Huss, and it has become one of the most popular publications in the makerspace movement. The magazine offers detailed instructions on a wide-array of DIY and 'hacker' projects. (Holman, 2015)

image source: makemagazine.com

2006

In 2006, TechShop was founded in Menlo Park, California, as a membership-based makerspace that provided access to a wide range of tools and equipment, including 3D printers, laser cutters, and CNC machines. TechShop became a model for other makerspaces and helped to popularize the concept of makerspaces as places for innovation and entrepreneurship. (la rédaction, 2017)

image source: https://www.makery.info/en/2017/12/19/alors-techshop-fermera-fermera-pas/

2006

The first Maker Faire was held in San Mateo, California, as a gathering of DIY enthusiasts and makers. An initiative of Make magazine, the Maker Faire has since grown into a global movement, with events held in cities around the world. (Make Magazine, 2015)

2009

In 2009, the Fab Foundation was founded as a non-profit organization to support the growth of digital fabrication and makerspaces, and includes the Fab City Initiative. The Fab Foundation provides training, resources, and support to makerspaces globally. (Fab City Global Initiative, 2014)

image source: https://fabfoundation.org/

2010-2023

The past decade has seen a rise in small-scale making, community-centric makerspaces, fablabs, and innovation spaces. However, with these opportunities and potentials, challenges arise in funding, scalability and sustainability. (Anderson, 2012)

2011

An early adopter of the library makerspace model, the Fayetteville Free Library, in New York opens. They were the first library to provide open access to the tools of making, including 3D printing.

image source: https://www.faylib.org/

2013

Opened in 2006, the Third Ward, a well-known makerspace in Brooklyn closes abruptly, leaving small business owners without access to their materials, facilities and equipment, and staff without jobs. Members that paid thousands for lifetime memberships have lost their investment. (Grearson, 2014)

image source: https://www. brooklynpaper.com/livestream-to-occupy-3rd-ward/

2014

The White House hosted its first annual Maker Faire where "tinkerers, builders, entrepreneurs, inventors and creators converged in our nation's capital to celebrate the Maker Movement." President Obama proclaimed June 18, 2014 a National Day of Making, saying, "I call upon all Americans to observe this day with programs, ceremonies, and activities that encourage a new generation of makers and manufacturers to share their talents and hone their skills." (MakercityLA, 2014)
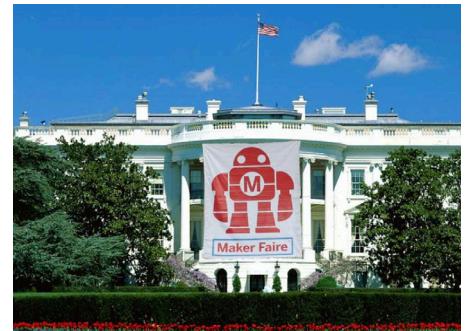

image source: https://www.makercityla. com/maker-city-la/2014/06/first-ever-white-house-maker-faire-unites-nationofmakers

2016

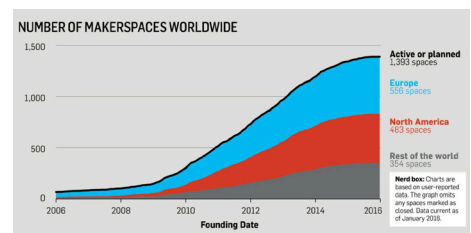User reported data in 2016 shows a rise in makerspace development globally. (Lou & Peek, 2019)

image source: https://www.popsci.com/ rise-makerspace-by-numbers/

2016

One of America's largest nonprofit makerspaces, OpenWorks in Baltimore, Maryland is founded to help rebuild Baltimore's manufacturing economy with the community. (Open Works, n.d.)

image source: https://www. openworksbmore.org/

2017

TechShop abruptly closes its doors. Rapid over-expansion and unstable funding are mostly to blame for the failure of TechShop, leaving many entrepreneurs without a space to continue developing their product. (la rédaction, 2017)

image source: https://www.makery.info/ en/2017/12/19/alors-techshop-fermera-fermera-pas/

2020

The covid-19 pandemic forever changed how people work and how product is manufactured, shipped and sold. Massive shifts in global supply-chain and access to raw materials, in tandem with geopolitical conflict and inflation is rapidly reshaping the manufacturing landscape. (Gamio, 2021)

2021

In a 2021 report, Etsy processed $10.28 billion in gross merchandise sales in 2020, an increase of 106.84% over the previous year. More people are engaging in small-scale making, and more people are purchasing these "hand-made" goods. (Dean, 2021)
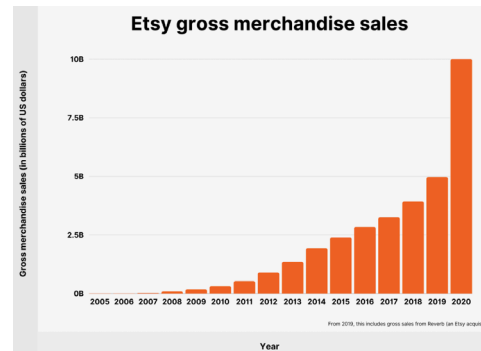

image source: https://backlinko.com/ etsy-users

2022

The Maryland Makerspace Initiative bill passes with emphasis on makerspaces as a means for economic growth and entrepreneurship. It is the first state in the country to establish such a program, which is designed to foster a community network of makerspaces rather than a single facility. OpenWorks in Baltimore serves as a model facility for the new program. (Leaderman, 2022)
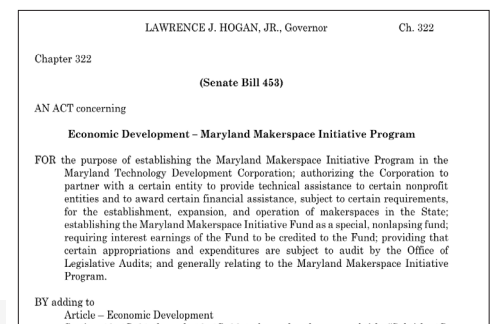

image source: chrome-extension:// efaidnbmnnnibpcajpcglclefindmkaj/ https://mgaleg.maryland.gov/2022RS/ chapters_noln/Ch_322_sb0453T.pdf