The Best of Emerging Tech

A coloring book

By Rachel Mintz

Acknowledgements

Thank you to Professor Ornes, for assigning this project. I enjoyed being able to practice my communication skills through such a fun medium. I also wanted to thank some of the sources which I used below. My work could not have come together without the incredible discoveries that are happening today, as well as those that set the precedent or inspired today's science. I hope you enjoy coloring emerging technology!

Introduction:
https://news.nationalgeographic.com/2017/07/woolly-mammoths-extinction-cloning-genetics/
"I think there is a world market for maybe five computers."
- Thomas Watson, president of IBM, 1943

Big Data:
https://www.ibm.com/analytics/hadoop/big-data-analytics
https://digitalcontentnext.org/wp-content/uploads/2018/08/DCN-Google-Data-Collection-Paper.pdf
https://news.vanderbilt.edu/2018/11/01/study-of-google-data-collection-comes-amid-increased-scrutiny-over-digital-privacy/
https://www.qma.com/assets/pdf/QMA_Letter-Bridge_Too_Far.ADA.pdf

da Vinci Surgical System:
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https://www.davincisurgery.com
https://www.alliedmarketresearch.com/surgical-robotics-market

CRISPR:
https://www.nature.com/articles/d41586-018-07607-3
http://wcsj2017.org/good-bad-unclear-talking-gene-editing-jennifer-doudna/
https://www.ncbi.nlm.nih.gov/pubmed/8976157
https://ghr.nlm.nih.gov/primer/genomicresearch/genomeediting
https://ghr.nlm.nih.gov/condition/tay-sachs-disease
https://www.nature.com/articles/d41586-018-07634-0

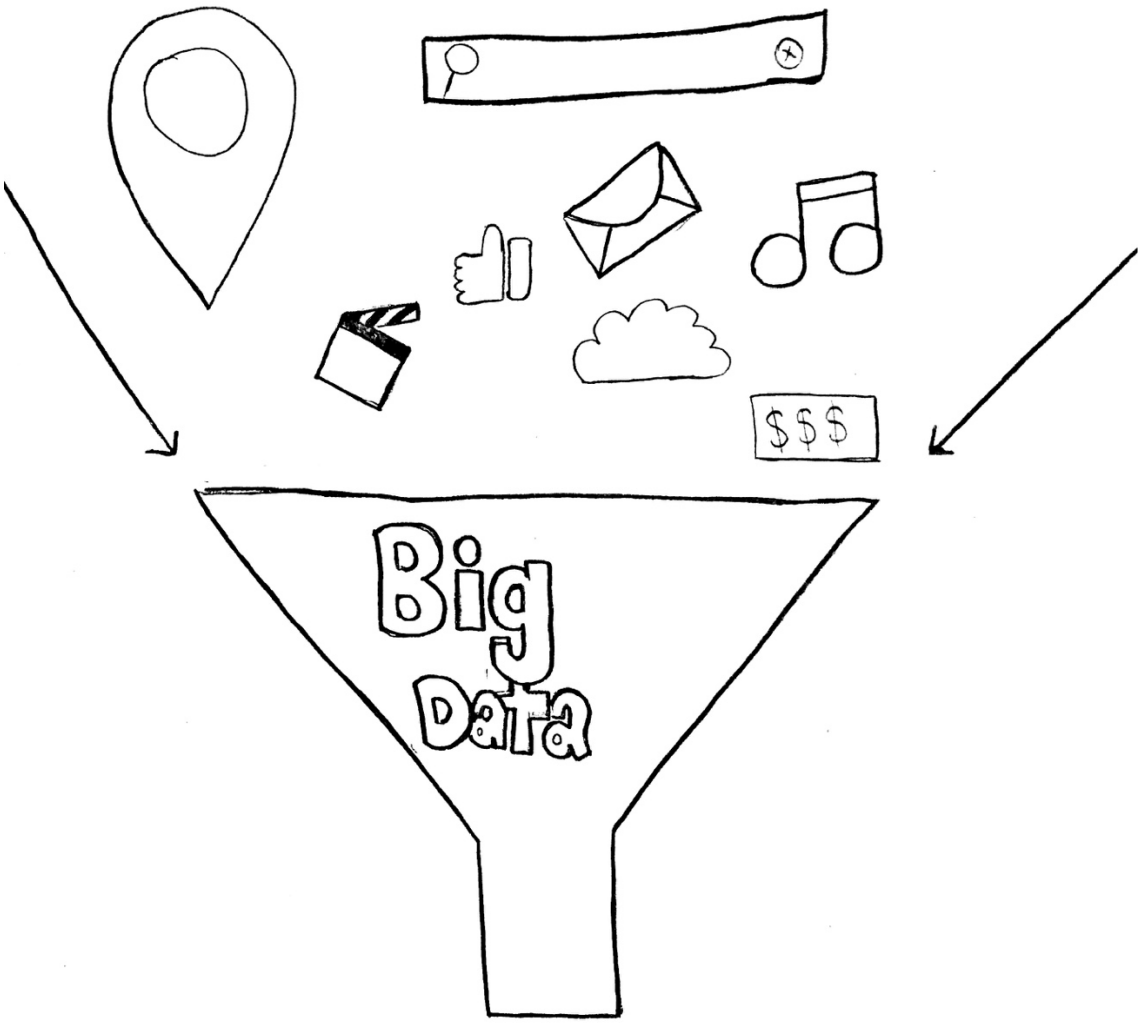
Introduction:

Jurassic Park is a 1993 science fiction thriller in which dinosaurs are brought to life to fill a zoo like amusement park, before the park encounters unpredicted technological difficulties. Science fiction, such as the kind found in this movie among many others, is on the verge of becoming reality. Scientists are looking to use CRISPR technology to bring a Woolly Mammoth, back to life, to try to stabilize present-day ecosystems. In some cases, movies are able to look at trends, and accurately predict the future. While human interest is not constant in one idea or field, ideas people can currently conceptualize often become targets for the future.

Humans, however, can also enter an unchartered territory, that is hard to predict. Where Thomas Watson, the president of IBM in 1943 only saw, “a world market for maybe five computers," many people now carry the devices around in their pockets. The result of the computer not only shaped many industries, but created new ones. Robots, for example, have begun to shape the medical industry, as engineers begin to build surgical systems that can outperform surgeons alone. New industries include that of Big Data, which gives companies information on their consumers, in hopes of improving their commercial experience.

Whether technology is predictable, or not, acceptance of its value can inherently increase the quality of life of humans. This coloring book aims to showcase some emerging technology, through a combination of the history of the field, current research, and the possible future. I hope you enjoy coloring emerging technology!

"Big Data Collection"



The Benefits of Big Data

Google is tracking you, but it may be to your benefit.

A recent study conducted by Douglas C. Schmidt, a Cornelius Vanderbilt Professor of Engineering at Vanderbilt University, tracked how often Android phones sent data to Google, and what information the phone sent. This study hoped to help researchers further understand how tech giants, like Google, obtain information about its users. He found that the phone frequently sent data back to Google, both passively and actively and by the end of the day, was able to predict a user's interests.

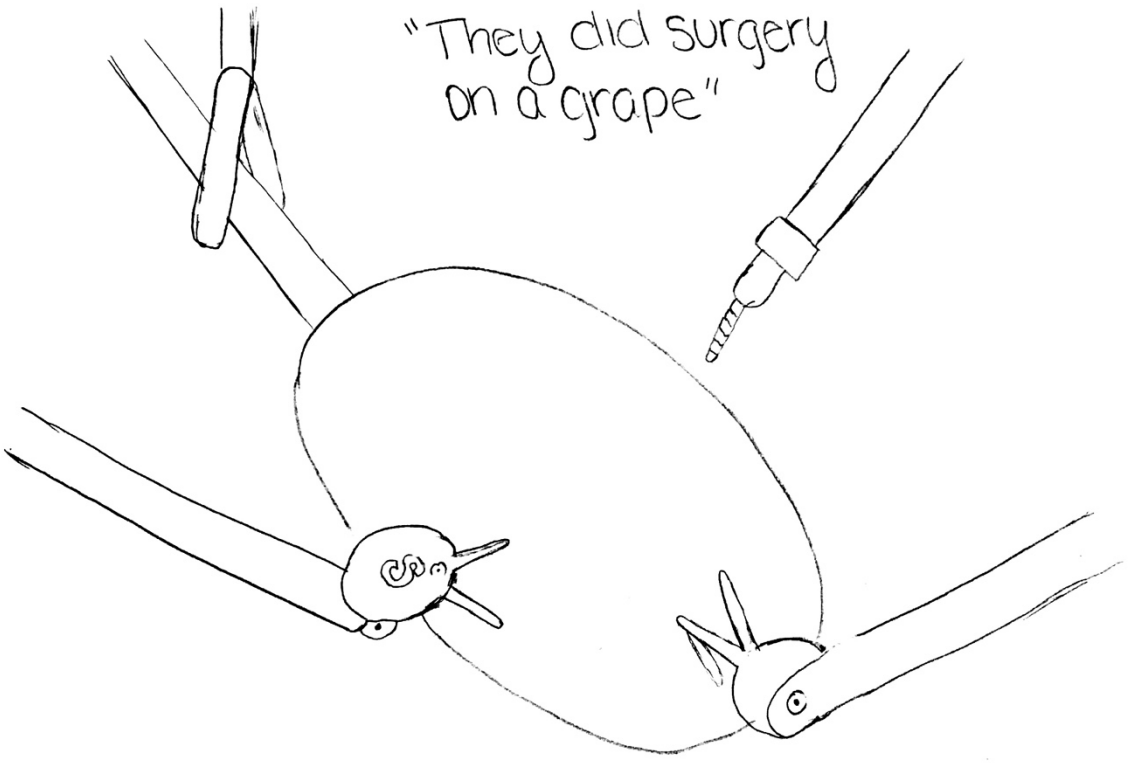
Schmidt simulated a "day in the life" of a fictional person, "Jane." A new Google account was made in her name and linked to a factory reset Android phone and a new SIM card. A researcher then carried around the phone for a day, and Google's data collection was monitored through two known methods, named "My activity" and "Takeout." Schmidt found that, after the day, Google was able to accurately predict eight out of the eighteen provided interests of "Jane." He also learned that two thirds of the data Google collected was passive data, meaning that the user was not notified of its acquisition.

So, how did Google profile "Jane" so easily? Google used big data to categorize "Jane" based on other user's interests compared to her own.

"[Big data is] large amounts of data often coming in large volumes with often a large range of data formats … so you might have data that comes from … an MRI machine or a power grid or cameras on an interstate," says Schmidt. "Nowadays, the cutting-edge uses are to analyze it in some way to try and extract meaningful information that has some type of … value." The ability to get data from numbers isn't easy, but is useful technology for businesses across disciplines. For doctors, it could mean being able to more accurately predict MRI results through previous patient's data, and for transportation workers, it could help monitor traffic levels in hopes of decreasing congestion on the road.

In finance, big data can prove to be an advantage in stock selection. "Big data is a huge area of investment for firms because there is intense competition among investment managers to get proprietary information that others don't have to make superior investment decisions," says Stacie Mintz, a Managing Director at Quantitative Management Associates. Big data can allow investment analysts to build models based on trends in society, and their effect on certain stocks, giving these investors an advantage over their competitors.

In present day, the benefits of big data to consumers are overwhelming. It allows individual users to have a personalized experience, complete with detail tailored to their needs. Many warn, however, that if legislation is not included in the future, problems may arise. If companies are not stopped, and they are able to interpret not only human interests but emotions, they could possibly play to that in their ad selection, which could be considered a violation of consumer rights. For the time being, however, Google and other major cooperation's use of Big Data should be looked at as an added bonus to the consumer, ensuring a personalized experience.


"They did surgery
on a grape"

The Evolution of the Da Vinci Surgical System

A new meme claiming "they did surgery on a grape" has recently become popular amongst social media outlets. It leaves many asking, however, who is "they" and why a grape?

In 2010, surgeons demonstrated the precision and effectiveness of the da Vinci Surgical System by peeling a grape's skin and suturing it entirely with the robot's technology. The surgeons performed the operation in Edward-Elmhurt Health's Edward Hospital in Naperville, Illinois, and chose a grape for its thin, delicate skin, and often slippery nature. The surgery was a success, but remained relatively unnoticed by social media. While the video resurfaced earlier this year, and was introduced on social media in the form of a meme, the robot today has evolved much from the Da Vinci robot in 2010.

In early 2000s, Intuitive Surgery became the first company to have a robot that was able to perform surgery approved by the U.S. Food and Drug Administration (FDA). The machine, named the da Vinci Surgical System, is operated by a surgeon behind a computer screen, but robots perform the actual surgery. Compared to a traditional surgery, the instruments used are much smaller, the incisions and actions are more precise, and the visibility for the surgeon is greater.

Since 2010, the da Vinci Surgical System has been cited as a main factor in the boom of robotic medicine in the New York Area. The machines are far from perfect, costing an estimate $2 million each, and needing many upgrades to perfect the work. Its use, however, is already having a positive impact on its patients. Its enhanced ability to perform the surgery leads to less strenuous recoveries due to the smaller incisions made by the machine compared to that of a human. One patient, who underwent a severe hernia surgery, was discharged from the hospital in 2 days, and felt little pain. Without the machine, this surgery would have been risky, required an incision from her chest to abdomen, and left her recovery time at approximately 2 months.

This machine is a big step in the medical world's transition to technology. Robots like the da Vinci Surgical System are one of many ways that technology is being incorporated into everyday life.

"Robotic surgery has its benefits and drawbacks," says Melanie Ramp, a nurse whose patients frequently undergo surgery utilizing the Da Vinci robot. "The biggest benefit is the degree in which instrumentation can be manipulated inside the cavity. This makes robotic surgery unique in comparison to other forms of minimally invasive surgery. The biggest drawback is that not all patients and procedures qualify for surgery performed with the robot."

The Da Vinci Surgical System's use, however, is far from perfect, as it still has many malfunctions, both with the physical machine and its software. Mechanical malfunction or instrument malfunction were the most common failures for the machine itself, while system errors were most common for the software. Scientists assessing the danger and frequency of the da Vinci Surgical System's mistakes found them to be rare, and did not find the machine to be a danger. Many hope that the popularity from this meme increases not only acceptance of robotic surgery but the demand, encouraging people to accept this new form of technology. For some, it has greatly improved the quality of their experience going under the knife, and for the grape, it has meant internet fame.

"CRISPR babies allegedly born in China"

How does the alleged birth of CRISPR babies affect science and humanity?

Most parents dream of shielding their children from harm, but would they go as far as to edit their DNA? This may soon be a possibility.

He Jiankui, a genome-editing researcher from China, has allegedly genetically modified the genomes of twins, Luna and Nina. He claims that he used CRISPR, a DNA editing tool, so the twins lack the gene normally used by the virus HIV to reproduce within humans. This would be the first case of a human precisely editing heritable genetic material.

The discovery was unexpected, as international science protocol does not condone scientists allowing genetically modified embryos to live longer than 14 days. Termed the 14-day rule, the limit was set because at 14 days of development, humans develop a primitive streak, a major factor in cell specificity. The rule was created in 1979 after the first in vitro fertilization (IVF) baby was born a year earlier, and ethicists believed there was a need to regulate experiments on human embryos. At this time, most labs could not keep embryos alive for more than a few days.

CRISPR technology was first discovered by Jennifer Doudna in 2012. This technology encouraged the field of genetic modification. Initially, the hypothesizes tested created genetically modified crops that were more pest resistant and had a higher yield, as well as a baseline understanding to animals' reactions to the modifications through experiments conducted on genetically modified zebrafish.

Then, in 2016, scientists in America and the United Kingdom reported being able to keep an embryo alive at least 13 days, finally challenging the limit of the 14-day rule. This sparked discussion about a possible need to modify the rule. Especially coupled with the introduction of CRISPR, the 14-day rule, in many scientist's opinions, became a means of hindering the future. Genetic editing had already proven to be both legal and effective in cells that were not heritable. Other IVF scientists identified some features of their patient's baby's genome, such as gender or some disabilities. Nobody broke the 14-day rule, however, until 2018.

The implications behind the CRISPR babies has sparked the discussion even further. Many believe Jiankui should be punished for violating the international rule. Others, however, support his decision, believing his discovery was a necessary step to continue the future of society. Allowing embryos to live past 14 days not only would allow for the continued research on CRISPR, but allow scientists to better understand miscarriages, and why some women have trouble getting pregnant. Many believe, additionally, that changes in societal norms warrant an extension of this rule. In 1979, the rule was formed after one IVF baby was born. Today, 2 percent of all children born in the United States are IVF babies. This discovery prompts discussion on possibly extending the rule to learn more about natural fertilization, IVF, and genetic disease.

Now scientists stand at a crossroads, where they must decide between the ethics of research on embryos and what to do with them. Many see CRISPR as the way to prevent children from being born with genetic diseases, while others warn of the implications not only of genetic editing, but scientists breaking international protocol. Some recommended an international moratorium on the study of genetic editing. Many scientists, however, don't think this is the course of action best for the future of humans. Dr. Thomas Clements, a biologist studying CRISPR at Vanderbilt University, is a major proponent. "I think if we can use this to cure childhood diseases let's push this as far as we can go," said Clements. "Before we have such a moratorium let's see if we can actually do it."