The Need for Social Distancing

Lessons Learned from COVID-19

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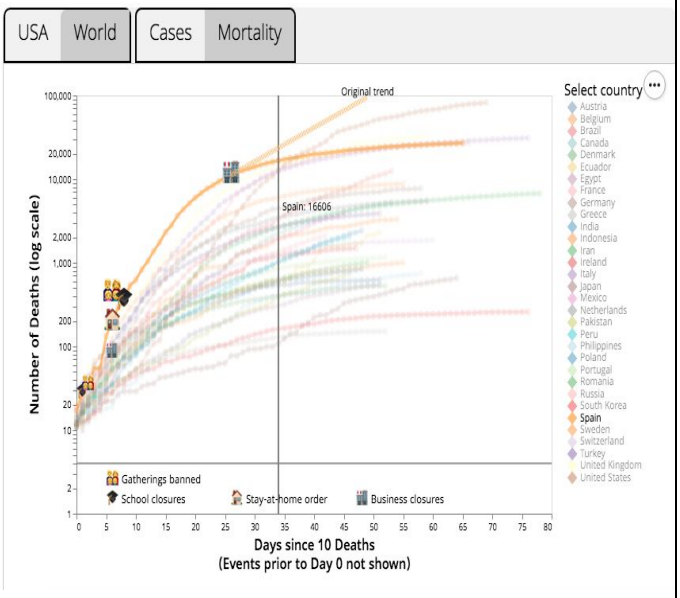
Project Goals

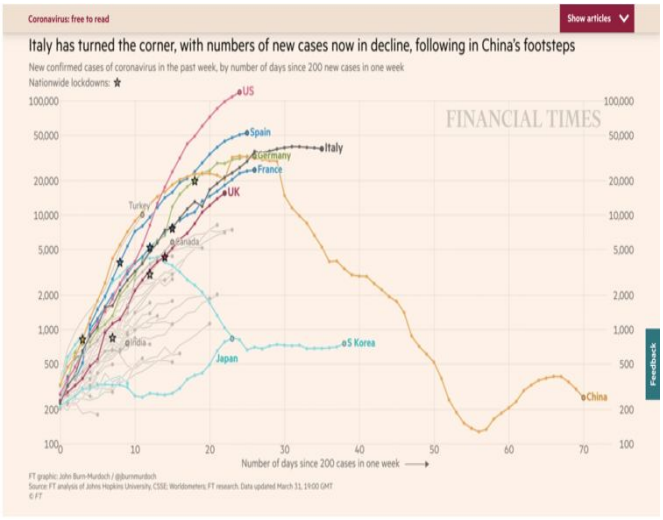
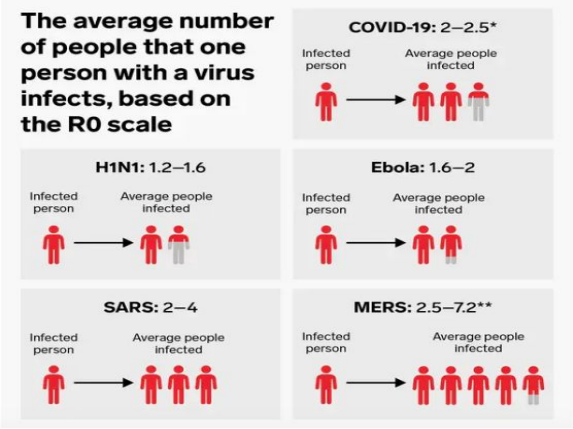
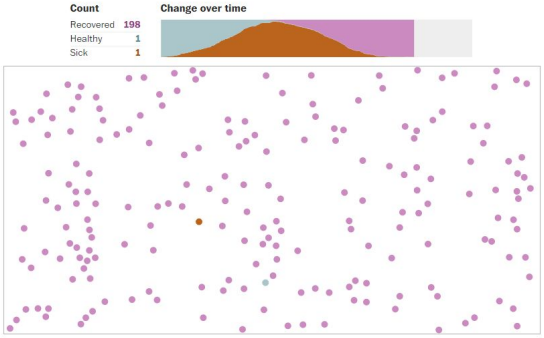
As of March 13th 2020, the highly contagious COVID-19 virus with strong person-to-person spread has caused a global pandemic and led to nearly 140,000 accumulated infections and 5,000 deaths (WHO, 2020). Without a viable cure or vaccine during the outbreak, many policy makers decide to use social distancing and stop large gatherings as a method to slow down the spread, causing many disruptions in individual daily activities. This strategy was somewhat controversial in the beginning of the outbreak but seems necessary at later stages (Barclay and Scott, Vox, 2020). In this project, we want to use visual analytics and interactive visualizations to help policy makers and the general public to better understand the effect of social distancing in the case if we were to encounter similar events in the future. The economic & financial cost and benefit of social distancing is not within the scope of our project.

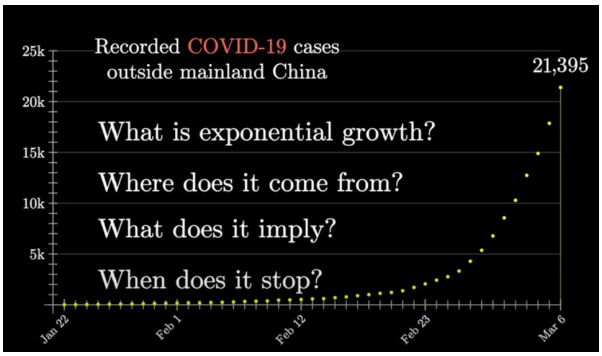
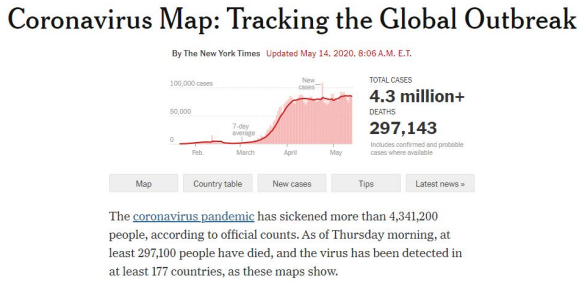
Related Work

Covidvis

A team of researchers and professors from UCB, UIUC and Gtech created a dashboard to particularly visualize the intervention effect of various social distancing policies. Interestingly, they used emoji icons (💼, 🏠, 👨👩👧👦, 🎓, 🍔, 🏢) to distinguish different intervention strategies, such as stay-at-home order, business/school closure and banning of gatherings, with each order's geographic coverage (regional/national) represented by the icon size. The impact of social distancing is effectively reflected by the flattening of a country's original trend. Inspired by their viz, we decided to use a reference line instead to indicate the date of government intervention.



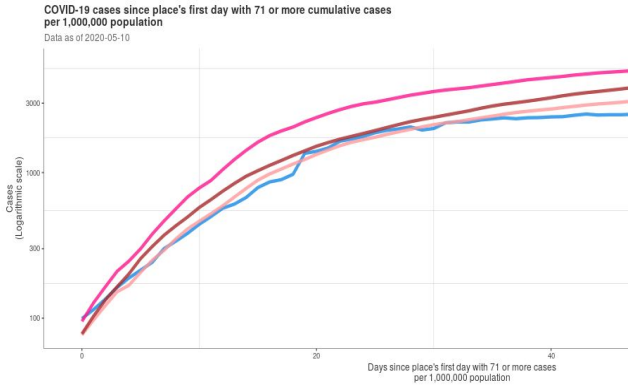
Social Distancing by Country Financial Times has produced a similar viz to demonstrate the effect of national lockdowns in slowing the spread of Covid-19. They similarly used a **star mark** to highlight the lockdown time and displayed the general pandemic trend of all countries on an identical relative timeline. In showing the increase of confirmed cases, they inspired us to calculate the moving average of 7 days instead of an absolute daily increase number, to more naturally depict the change in a country's overall trajectory.	
Comparison between Covid-19 and other virus infection Shayanne Gal from Business Insider made an infographic to visualize the R0 of Covid-19 and other infectious diseases. Users can gain an intuitive understanding about the seriousness of Covid-19, which has been downplayed by many policymakers. Inspired by this graph, we contextualized Covid-19 by comparing it with influenza in our introduction and explained why it's unfair to compare Covid-19 to the common flu.	
https://www.washingtonpost.com/graphics/2020/world/corona-simulator/ The Washingtonpost created a virus spread simulator that we pulled some inspiration from. The animations are very engaging and the Post has made the important inclusion of a line chart visualizing the number of infected over time. We found that this chart was very helpful in visualizing what "flattening the curve" looks like to readers.	

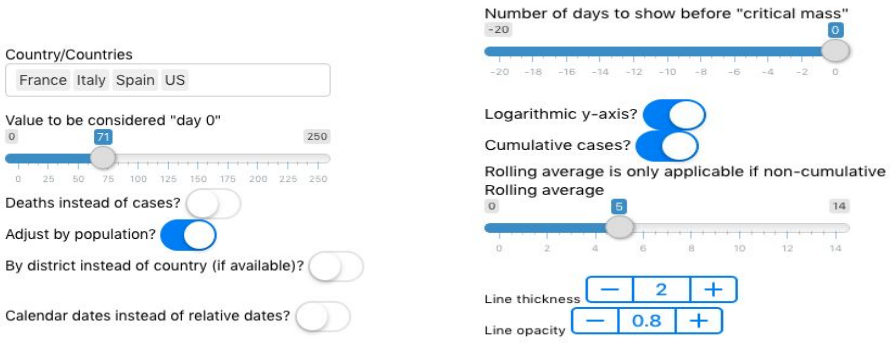
https://www.3blue1brown.com/videos-blog/exponential-growth-and-epidemics Grant Sanderson made a very detailed video explaining the spread of Covid-19 and quantifying what its exponential growth means. In our visualization, we really wanted to convey to our audience the magnitude of Covid-19's spread similarly to this video.	
https://www.nytimes.com/interactive/2020/world/coronavirus-maps.html The New York Times made a piece tracking the global outbreak of Covid-19. Their site has a coherent flow to it, beginning with visualizations showing which countries had confirmed cases and how many. We were inspired by the flow of this site, and also its inclusion of a call to action (advice on how to stay safe during the pandemic) so that users gain something actionable from our site.	
https://www.pbs.org/newshour/show/the-dangerous-global-flood-of-misinformation-surrounding-covid-19 This interview discusses the various misinformation being spread about Covid-19 during this panic. In particular, there have been cases where world leaders have downplayed the impacts of the virus. This misinformation has inspired us to include information in our site to help fight against misconceptions about Covid-19 and to point readers to credible sources where they can better inform themselves.	
Summary on state decisions and population (picture in the next page) The New York Times made a summary about how each state in the US is affected by the "stay-at-home" order. They visualized each state's independent decision on social distancing practices on a map overtime, to help readers gain an intuitive sense about which states are early/late adapters. They also incorporated the population size of each state to calculate the number of people all over the country that are affected by stay-at-home orders. We used their summarized data on state policies and ordered 3 groups of states by their population	

density in our section 2.

Databrew's Covid-19 epidemic curve explorer

Joe Brew built a very informative dashboard for comparing the epidemic curves of Covid-19 across countries. It's particularly powerful because many variables are made adjustable/flexible so that users can explore the pandemic growth from multiple perspectives. For example, users can choose the timeline or be calendar dates or relative dates and adjust the start date (a threshold when confirmed cases reach a certain number). They are also given the freedom to select the log scale of y-axis, day-specific versus cumulative cases, etc…





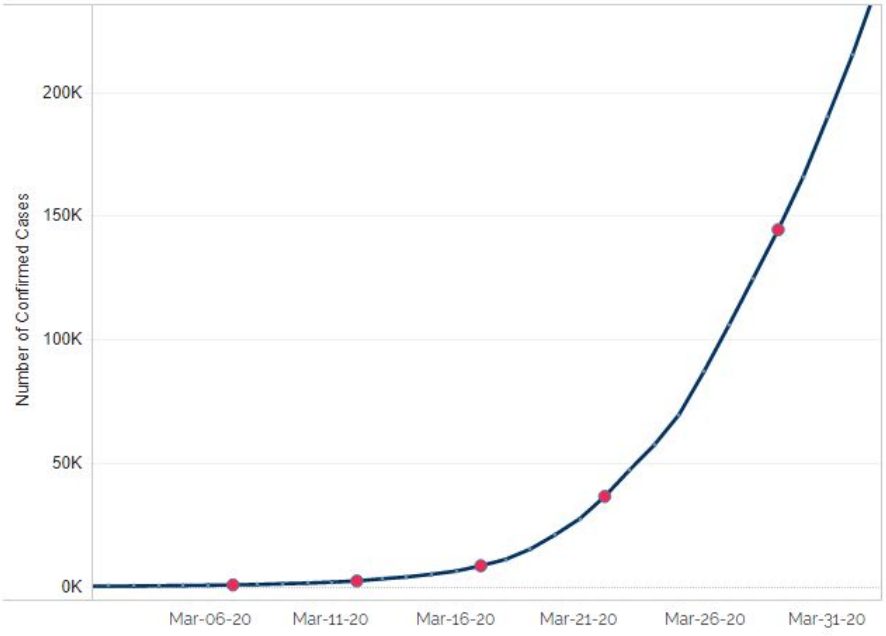
Visualization Descriptions

Section One:

Before explaining the importance of social policies in response to Covid-19, it is important to make sure that readers of our website have some background about the virus. Our introduction section serves as a way to explain to readers the basics of Covid-19, such as what it is exactly and why it is so important to the public's interest.

We want this section to be concise, so as to not require too much effort to understand, and to clearly portray the magnitude of Covid-19's spread. The first visualization shows Covid-19's growth curve from the beginning of March to the beginning of April. Here we have highlighted points red to mark when the total number of confirmed cases have roughly quadrupled, starting from 538 confirmed cases. The color scheme was chosen to make these specific dates pop out to users. Once users' attention is grabbed by the red points, they can then mouse over them to view specific details (date and number of cases).

Figure 1:
U.S. Covid Positive Cases



The second visualization is meant to contextualize Covid-19's spread compared to more common past diseases, pneumonia and influenza. These two diseases were chosen specifically since there have been many people claiming that Covid-19 is just like the flu and thus is being blown out of proportion.

In the graph we compare the number of new deaths per day caused by Covid-19 during a 1-month timeframe and compare it to the number of new deaths per day caused by pneumonia and the flu, focused during a similar timeframe when the death rate was increasing most. Points highlighted red in the top chart mark when the number of new deaths has doubled since the last highlighted points (starting from March 22). Points highlighted red in the bottom chart similarly mark when this value has doubled (starting from December 10). The greater number of highlighted points in figure 2 is meant to show how much more often the number of deaths per day have doubled for Covid-19 than pneumonia and influenza.

We decided to use a vertical layout so readers can more easily compare the x-axis of the two charts and thus more easily compare how growth of casualties for each disease compare. In addition, we also chose to use the same y-axis scale between the two charts to make the diseases' growths more visually comparable.

Figure 2:
U.S. Covid-19 New Deaths Per Day

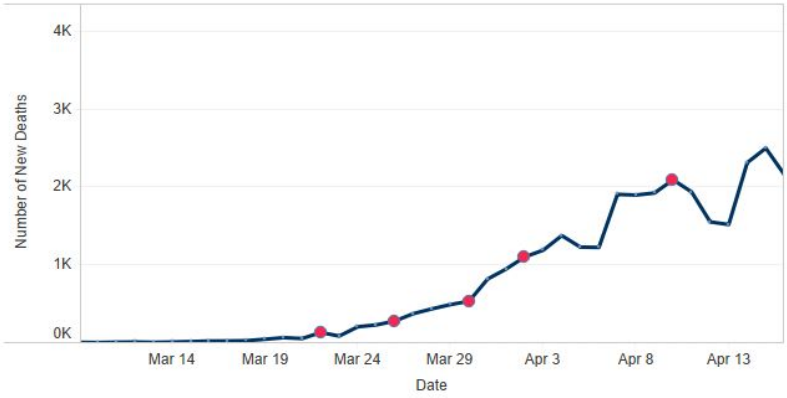


Figure 3:
U.S. Pneumonia and Influenza New Deaths Per Day

Section Two:

After informing users about the exponential growth and seriousness of Covid-19, section 2 aims to focus on social distancing as a way to slow the spread of the disease. Specifically, we plan to introduce both the effectiveness of social distancing and the importance of its timely implementation. As the virus is spreading wildly all over the world, we want to start with a vis that helps users to understand the big picture of different countries' reactions to Covid-19. The tableau dashboard below was created to show when different countries decided to enact social distancing and how that corresponded to any trend changes in the national growth of confirmed cases. We narrowed our selection of countries to the 15 most heavily affected countries, excluding China and US due to their highly independent regional decisions.

Using line graphs, we illustrate the trend of each country's confirmed new cases over time since the date of that country's first confirmed case, with each country denoted by a different unique color. We used a log scale in order to best capture the overall trend of growth number. Users can also hover on a specific dot in a line to view more detailed information for specific growth number and time. In the bottom bar chart, we visualized the number of days that countries waited to issue social distancing orders after the first confirmed case. Each country is also denoted by a unique color, which is consistent with the color in the top line chart. We also included a reference line to show their average waiting time (around 50 days) to help users to more easily compare countries' reaction time to start social distancing practices (eg. lockdown, shelter in place, etc…).

Finally, we linked the two charts to add interactivity of our viz. Upon users' highlighting of a specific country in the **line chart**, the **bar chart** of that country will also be highlighted accordingly and vice versa. Users can obtain the time of social distancing implementation as a "mental" reference point and would find that curves bent down not long after social distancing was put in place. By default, Iran, the United Kingdom and Japan are highlighted as examples of early, average and later adapters respectively. This is intended to give users a good start to explore the correlation between implementation time and the flattening of curves.

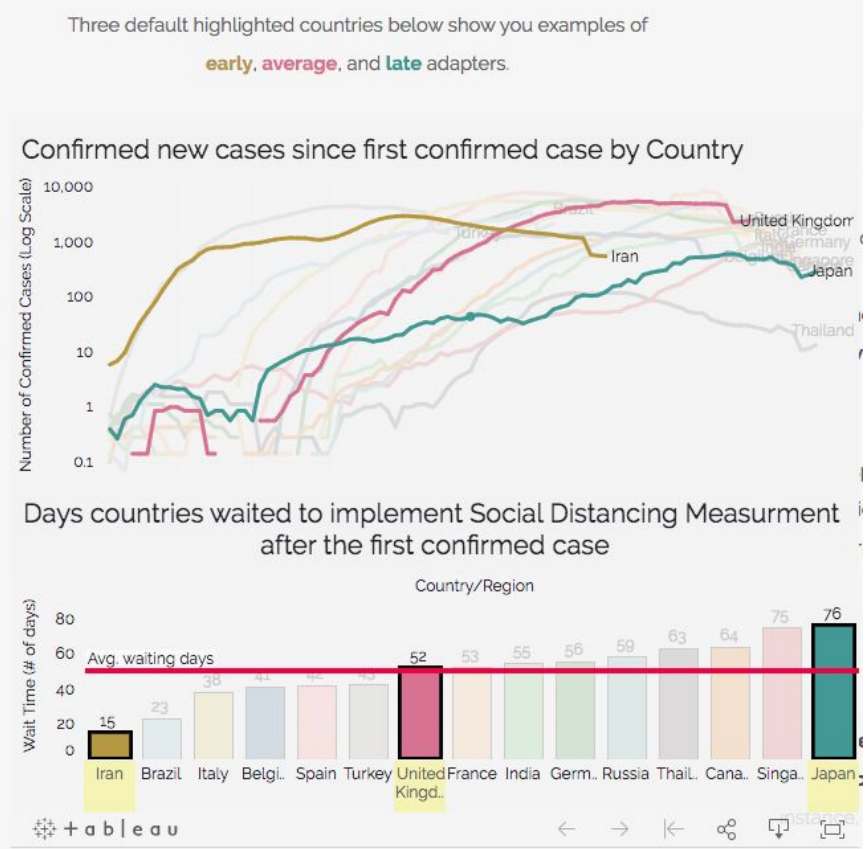


Figure 4. Time of social distancing and growth of confirmed cases in different countries

After presenting the global picture to users, we shift our focus to the U.S. to make this section more relatable, considering that our primary target audience are U.S. citizens/policymakers. Given a high degree of autonomy, different states made independent decisions on social distancing. We first selected and organized 3 groups of states by their **total population density (high, mid and low)**. Then we chose 3 states for each group and further ordered them by the **earliness of their social distancing policies** to compare pandemic growth trends of early adopters and late adopter states. The specific dates on the x axis are all excluded for the cleanness/simpliness of the graphs, but all graphs are made with a consistent fixed range of dates. Users can still hover on the line to view more detailed information for a specific date. We exclude x axis ticks in order to better draw users' attention to the reference lines that indicate the start date of each state's social distancing orders.

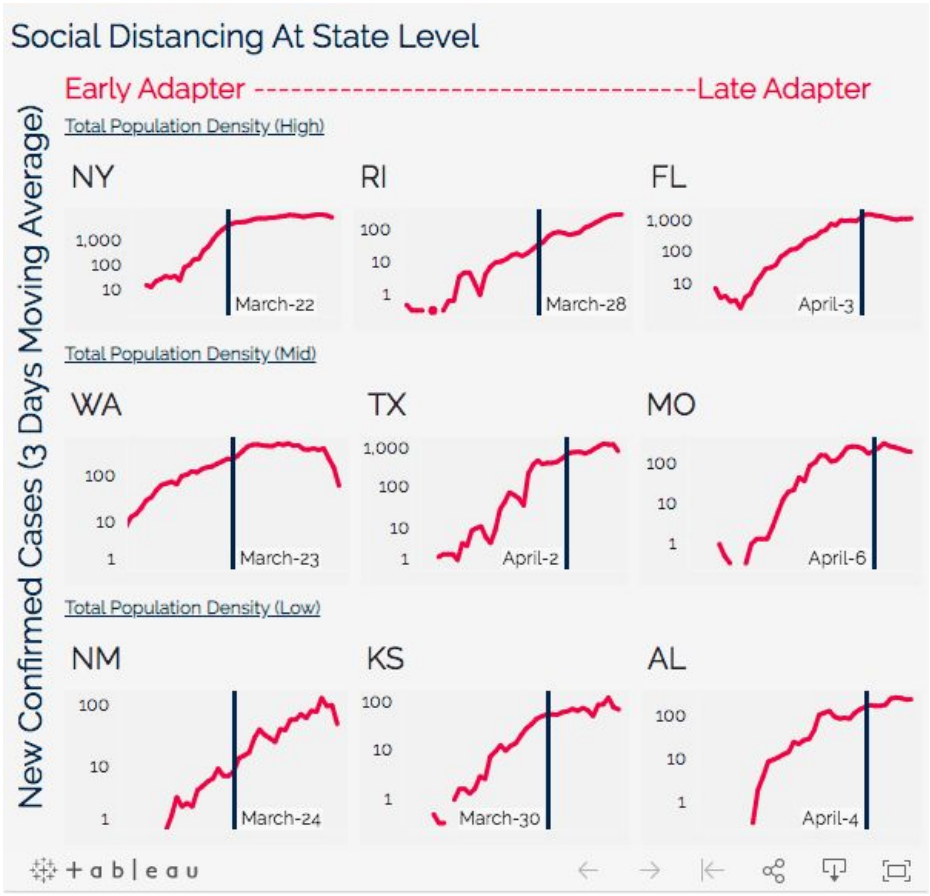


Figure 5. Social distancing and infection growth trend in US states

Section Three:

To reinforce the idea of exponential growth and the need of social distancing in the earlier sections, we included an interactive simulitis where users can tweek different settings and see how this affects the spread of a simulated disease. We wanted to include this simulitis at the end since interactivity can help users to experience effect and solidify learning.

We realize the limitations of the simulitis may not reflect how individuals behave in society as many complex real-world factors can't be fully accounted for. However, we think the ability to interact will help users to become increasingly aware of the danger of ripple effect and potential exponential growth of highly contagious disease.

In the final product, individuals are represented as circles and colored by whether or not they are infected (red for infected, navy for uninfected). Circles in the simulitis have a chance at becoming infected when they collide with an infected circle. To represent the social distancing effects, we designed a few factors listed below.

Users have control over 4 factors:

- The probability of the infection spreading on collision
- The percentage of circles practicing social distancing (not moving)
- The speed at which the circles move (given a same timeframe, faster movements will more likely to cause more collisions)
- Quarantine Box: adjustable box that can be used to cut off a portion of the circles from interacting with circles outside of the box

Along with the simulitis is a line chart that keeps track of the number of infected circles over a run of our simulitis. The line chart keeps track of both past/hypothetical simulitis infected count over time, as well as the count over time for the current simulitis. This will let users compare and contrast the results of their interactions with the simulitis to previous attempts, and give them a better sense of what settings best slow down the spread of disease.

We have created a very short demonstration of some of the interactions that users can have with our simulation. The demo can be found here: https://youtu.be/0PwF4ZMX9rg

Approach

Data

We leveraged the Github post referenced below, which gathers daily updates on COVID-19 from various data sources including WHO, U.S. CDC, China CDC etc.

For our introduction, since our website is aimed at US citizens and policymakers, we used Covid-19 case data from the United States to make this section more relatable and immediately relevant to our target audience.

In section 2, we used WHO's sequential data that keep track of the number of confirmed and death cases every day across the globe to depict different countries' pandemic growth trends. After data preprocessing, we added a new feature that counted the number of days for each country since its first confirmed case. Data on countries' date on social distancing implementations are gathered from Wikipedia "Covid-19 Pandemic Lockdowns" page and later joined with WHO's data to calculate each country's response time. Additionally, we also collected each US state's time of issuing stay-at-home orders from The New York Times and merged it with U.S.CDC data.

Tools

We used Tableau for most of our visualizations and Tableau public for visualization embedding. Interactive simulitis was created in an observable notebook with visualization libraries such as D3. Our project website is hosted on github and was made using HTML, CSS, and a premade template we selected from TEMPLATED.We also used python for our data pre-processing and creating a relative time to track each country's case number since the day of the first confirmed case. Additionally, we attempted to set up serverless websocket API via Amazon AWS with a more interactive global click counter but didn't succeed. Instead, we used page view counter service to keep track of total views of our site.

Steps

1. **Initial Prototyping**
   During our initial prototyping we worked on tentative designs for visualizations we wanted to include in our website, as well as the beginning designs for our viral spread simulitis. These prototypes were then used to help us storyboard our website.
   Tools: Adobe illustrator

2. **Visualization, Simulitis, and Storytelling**
   After iterating through different potential website layouts, we agreed upon breaking our website into 4 main sections: introduction, slowing the spread of Covid-19, simulitis, conclusion and providing actionable resources. We divided our work and each separately worked on different sections of the website.
   Tools: Tableau, Observable Notebook and visualization libraries such as D3, HTML

3. **Usability testing and Feedback Implementation**
   Once we had a completed prototype of our website with appropriate visualizations and a completed interactive simulitis, we tested our site with 5 volunteer interviewees. Each volunteer was given a set of questions to answer both before and after interacting with the website as a quantitative measure testing what they learned. Volunteers were also interviewed about their experience using the site. Based on this feedback, we made updates to our site. More details about our usability study are covered in later sections of this report.
   Tools: Google forms, paper forms

Usability Testing and Results

Introduction

The current interactive website creates an interactive visual story to inform the public about the seriousness of coronavirus and the reasoning behind social distancing practices. Specifically our goal is to visualize the need for, timeliness, and effectiveness of social distancing practices in containing the virus' spread. The current website consists of 3 parts that enables users to learn, understand, and experiment with exponential growth. These 3 sections cover the following: (1) highlight the seriousness of Covid-19's early exponential growth by comparing it with other diseases. (2) how the timing of social distancing mattered for different countries across the world and different states in the US (3) what we can do to slow down the Covid-19's exponential growth. Ultimately, this interactive visual story is intended to help raise the policy makers' awareness about the importance for timely social distancing and to encourage individuals to more actively practice social distancing for their own and communities' health.

The user testing is expected to help us gauge how effective our website is in helping users better understand Covid-19 and social distancing. Our subjects' feedback and experiences using our site helped us evaluate the strengths and weaknesses of our design, and also provided inspirations for our future improvement.

Method

We used both surveys and semi-structured interviews to collect users' feedback for our usability testing. In the very beginning of the survey, 6 questions were asked to gather background information about their age, prior experiences in information science and public health sector, as well as their initial perceptions about social distancing. Before being directed to interact with our website, users were given another 3 pre-test questions that measured their baseline knowledge about Covid-19 and social distancing. After interacting with the site, participants were then given the same set of 3 questions to see if their answers changed compared to their pre-test responses. Finally, users were verbally interviewed about their overall experiences interacting with the site (notes taken by the interviewer) and were asked to rate the effectiveness of the website on a scale of 1 to 5.

Participants

In total, 5 participants were selected via convenience sampling, they are all in the age group of 18-40 without prior experience in the public health sector. Around 40% of the participants had prior experience in Web Design, User Experience Design, Data Visualization Design.

Scenarios/Tasks (can link to earlier task descriptions if they haven't changed)

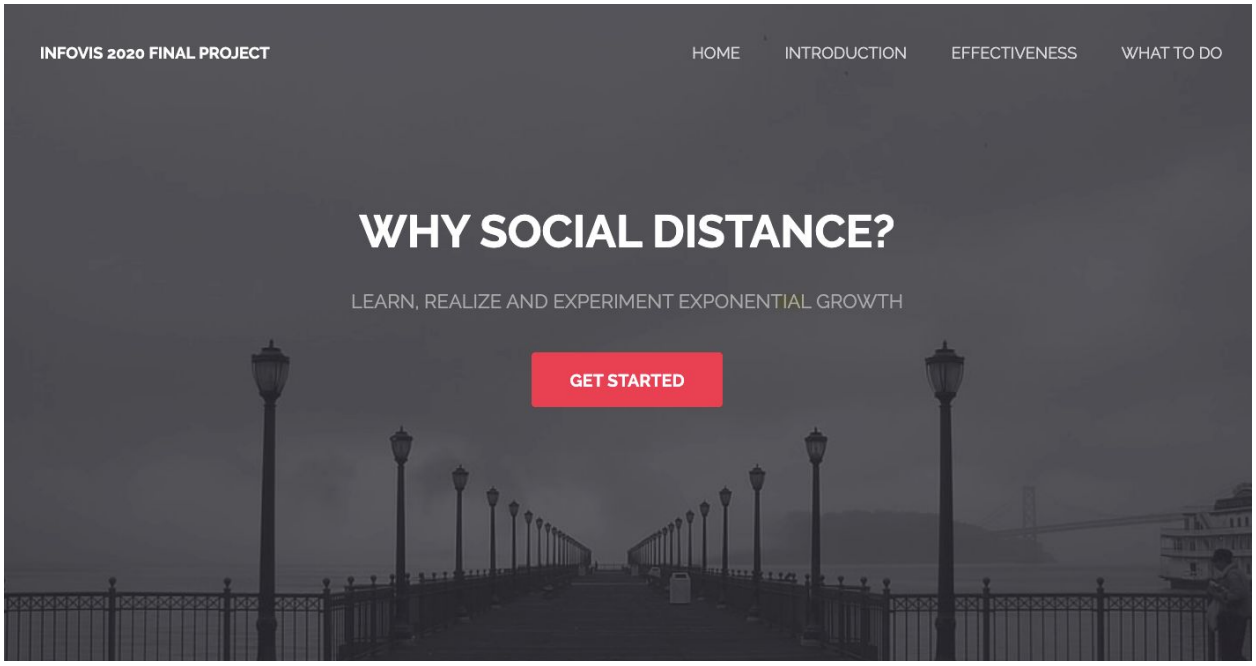
There are mainly two tasks involved in this useability testing:

1. Ask users to use interactive visual selection to learn and obtain informative data on exponential growth trend to answer test measurement questions

    Things that we looked for in this task:
    1. If layout and representation of the visualization charts are intuitive and meaningful
    2. If there are many major missing data points or representations that users would want to gain in order to answer the test measurement questions.
    3. Are the text associated with the visualization helpful in terms of explaining the section
2. Interact with simulitis and try to flatten the new curve to understand possible factors that cause exponential growth.

    Things that we looked for in this task:
    1. Are there any major bugs in the simulitis?
    2. Is the simulitis naturally something you want to interact with?
    3. Is the task to flatten the curve easy to tackle?

Screenshots



INTRODUCTION

WHAT IS COVID-19?

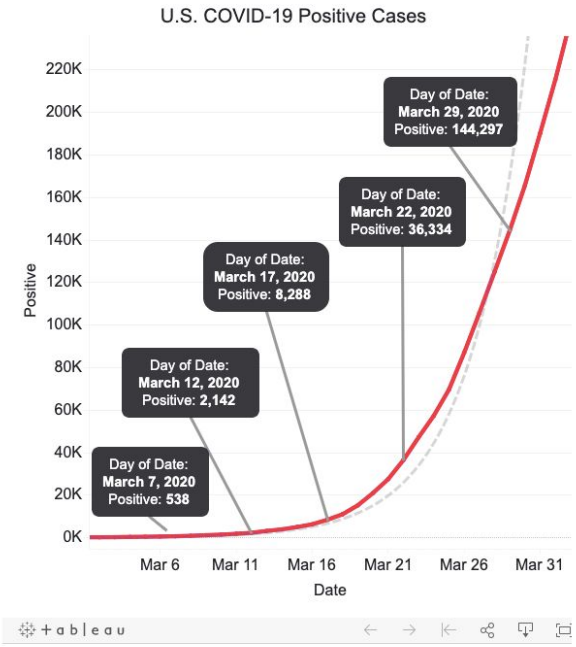
Covid-19 is a novel coronavirus, which means that it is a strain of coronavirus not previously identified. As noted by the CDC it is important to recognize that: "the virus causing coronavirus disease 2019 (COVID-19), is not the same as the coronaviruses that commonly circulate among humans and cause mild illness, like the common cold".

WHAT IS THE BIG DEAL?

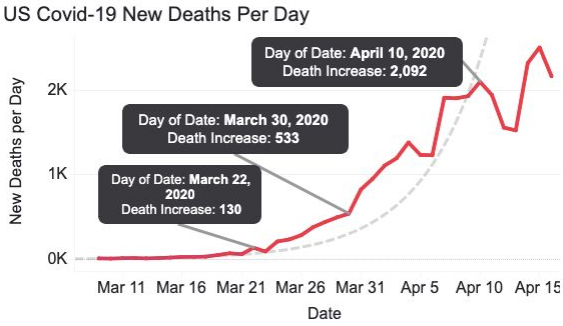
New strain of coronavirus. Since Covid-19 is new, there is no widespread immunity in the population, which makes communities more susceptible to the virus.Fast spreading. The virus is fast spreading and is thought to be transferred mainly person to person via droplets that result from coughing or sneezing.

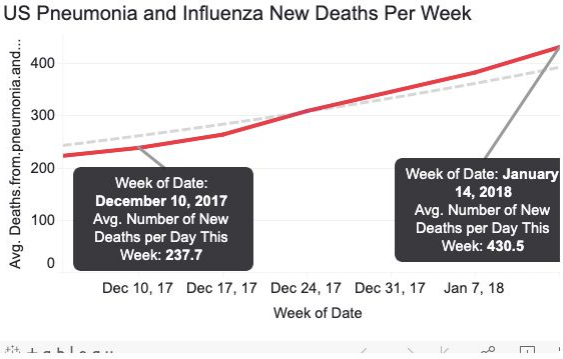
UNDERSTANDING EXPONENTIAL GROWTH

Because COVID-19 spreads so quickly, the period of fastest growth can be modeled using an exponential curve. This essentially means that the total number of confirmed cases increases by a factor every few days. Looking at the initial 1 month period when confirmed Covid-19 cases were rapidly growing we can see that the total number of cases quadrupled around every 5 days, starting from less than 100 confirmed cases at the start of March and rising to around 200,000 by April.

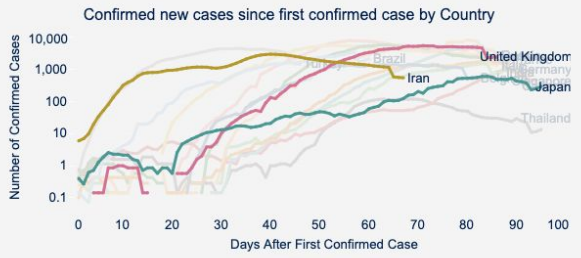


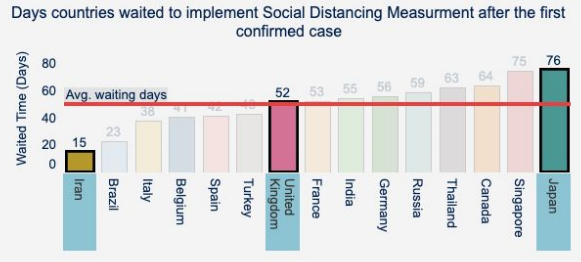
To understand just how quickly Covid-19 has spreading, we can compare the number of new deaths caused by the virus each day to the average number of deaths per day due to pneumonia and influenza during the 2017-2018 season. Over the course of a month the number of deaths per day due to Covid-19 quadrupled roughly once a week, growing from less than 100 to over 2000. Meanwhile during the one month period when pneumonia and influenza deaths were growing most for the 2017-2018 season, the average deaths per day rose from around 200 to around 450. For comparison, while it took around a month for the number of pneumonia and influenza related deaths per day to double, it took less than a week for Covid-19 related deaths per day to grow that amount.





SLOW THE SPREAD OF COVID-19





Disclaimer: Data as of April 13th, 2020. China and the U.S. are excluded in this chart because of regional and state independent decisions on social distancing measurement implementations.

SHOULD YOU WAIT?

TIMELY IMPLEMENTATION MATTER?

Chart on the left include newly confirmed cases in 15 countries with relatively high amount of total cases and associated average time in days its national government issued a shelter-in-place order (Average around 50 days). Three highlighted countries are simply examples of early, average, and late adapters. Use CTRL + Mouse click to highlight the countries of your interest and see if you have noticed any correlations. You can also hover to learn more details on the readings.

One of the things we've noticed is delayed effect. Newly confirmed cases in most countries only began to flatten 2-3 weeks after social distancing measurements are implemented. For instance, in the case of Spain, it took 15 days before new cases reached its growth peak and started to stabilize.

Additionally, we also find it interesting that countries such as Iran, Brazil or Italy with faster social distancing policies response (below average waited time) normally associate with a faster-growing and steeper exponential curve than countries such as Japan or Singapore. This may be an indication that social distancing policies are more of a reactive measurement than a proactive preventative decision. Given the likely negative impact on economic activities, social distancing may be one of the least

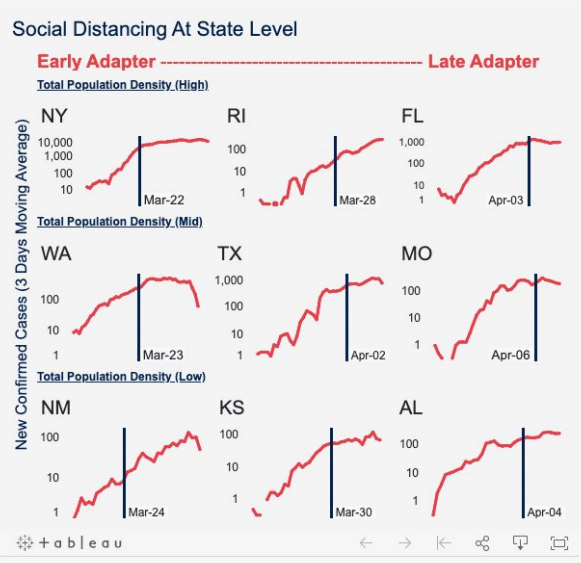
AUTONOMY

STATE DECISIONS

The chart on the right reflects different state implementations of social distancing policies in terms of early, average, and late adapters. The vertical lines are social distancing implementation dates implemented at the state level. Additionally, the charts are also arranged by state population density.

Different social distancing policies in the U.S. are not dramatically apart with the earliest in late March and latest about two weeks after. With given data, the effect of these measurements begins to show for the early adapters but may take longer for the late.

Although some of the effect may be less prevalent in less populated states such as New Mexico, where new cases continue to grow. It seems exponential growths in most states have been bent after social distancing policies are put into place. The most positive development seems to be in Washington State with newly confirmed cases clearly dropping compared to prior levels.



WHAT CAN WE DO TO STOP THE SPREAD?

A SIMULITIS

THE RIPPLE EFFECT

Now we had some understanding of exponential growth of a disease and possible social distancing effect on the spread. Let's try to visualize this effect. We created a simulitis on the left with a few adjustable sliders and a small section of interactive features to help demonstrate the possible effects on the speed of the spread. Try to utilize these features to slow down the spread and flatten the growth curve.

We realize this simulitis is an oversimplified representation of the complexity in real life. A ball bouncing across the screen may not reflect anything close to how we behave in our society. However, we wish the simulitis can be a way to demonstrate a single person's decisions and actions can have much greater ripple effects in our society during this special time.

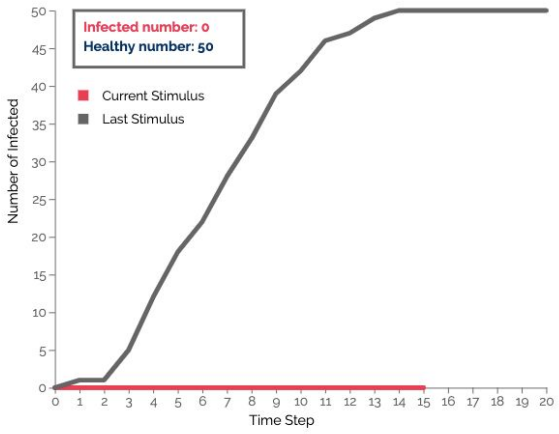
Parameters you can Adjust include: 1. Probability of infection: Probability a healthy ball will turn into infected ball after contact 2. Percentage of Balls will stay still 3. Speed of the balls Additionally, the interactive rectangle can also be a factor. Drag the infected ball to start action. Infection probability and stop ball probabilities are in percentage terms while speed of ball is arbitrary.

A NEW CURVE

BETTER SELF THIS TIME

The chart on the right reflects the number of infected balls growth trajectory. The grey line represents growth trend last simulitis while the colored line represents the real time growth of the current simulitis. If your goal is to slow down the spread (presented by a flattened curve) when an infected ball is introduced, how can you achieve this? Try it out.

The time unit on the x-axis is currently in 4 seconds interval. When we tried to run the simulitis without interventions, we often observe a quick surge in infected cases (Double or triple) of cases in a short time period while interventions more than often would result in a straightened or flattened line. That extra 4 seconds, 4 hours or 4 days may be exactly what our first responders or medical professionals need to save our loved ones around us.



CONCLUSION

COVID-19 HAS BROUGHT UNPRECEDENTED CHALLENGES FOR INDIVIDUALS, FAMILIES, AND COUNTRIES ACROSS THE WORLD. THE EXPONENTIAL GROWTH OF THIS NOVEL CORONAVIRUS HAS LEFT PEOPLE AND POLICY MAKERS WITH UNCERTAINTY ABOUT HOW LONG THIS PANDEMIC WILL LAST AND HOW MANY MORE LIVES WILL BE IMPACTED. WITHOUT AVAILABLE VACCINES AND EFFECTIVE TREATMENTS, ORDERS ON SOCIAL DISTANCING ARE ENACTED BY DIFFERENT COUNTRIES' NATIONAL AND LOCAL GOVERNMENTS TO LOWER INTERPERSONAL CONTACT RATE. FOR MANY OF THE HEAVILY AFFECTED COUNTRIES, SOCIAL DISTANCING HAS ACHIEVED A PRONOUNCED EFFECT IN CONTAINING THE VIRAL SPREAD, USUALLY WITHIN 2 WEEKS AFTER IMPLEMENTATION. ALTHOUGH IT DOESN'T COME WITHOUT COSTS, POLICY MAKERS AND EACH INDIVIDUAL SHOULD CONSIDER PRACTICING SOCIAL DISTANCING IN A TIMELY MANNER FOR THE SAFETY OF THE COUNTRY, THE VULNERABLE PEOPLE NEARBY OR YOURSELF.

I SUPPORT SOCIAL DISTANCING!

Test Measures

First, we measured and compared the accuracy scores for the first 3 questions in the pretest and posttest question set.

1. What is Covid-19?
2. Approximately how long do you think it took for the number of confirmed Covid-19 cases in the United States to go from 200 to 200,000?
3. Fill in the blank: The number of deaths per day caused by Covid-19 has grown at a rate _____ the number of deaths per day caused by seasonal pneumonia and influenza in the past.

These measures are intended to help us better estimate how well our information visualization and presentation can correct or expand users' understanding about Covid-19 and social distancing policies.

In addition, we also measured and compared the answers for the last question "Do you think that social distancing should be practiced in a timely manner?" in the pretest and posttest question set, in terms of users' support rate for the timely implementation of social distancing. With this measure, we aim to quantify (1) how much our website changed people's attitudes toward timely social distancing and (2) how much our website helped raise the public's awareness about the effect of social distancing's timing in containing the viral spread.

While previous measures are designed to be more section-specific, a likert scale question was included in the end to measure users' overall impression about our visal story. We asked users to rate the general effectiveness of our website in informing them about Covid-19 and social distancing so that we know if the site is coherent, organized and informative as a whole piece as well.

Results - Summary

Index	Question	Pretest Accuracy	Posttest Accuracy
Q1	What is Covid-19?	100%	100%
Q2	Approximately how long do you think it took for the number of confirmed Covid-19 cases in the United States to go from 200 to 200,000?	40%	40%
Q3	Fill in the blank: The number of deaths per day caused by Covid-19 has grown at a rate _____ the number of deaths per day caused by seasonal pneumonia and influenza in the past.	100%	80%
Q4	Do you think that social distancing should be practiced in a timely manner?	100%	100%

Results - Details

1 - Yes or Correct Answer 0 - No or Incorrect Answer

Questions	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Average
Age Group	18 to 40	18 to 40	18 to 40	18 to 40	18 to 40	
UX/Viz exp.	0	0	1	1	1	60%
Pub. Health exp.	0	0	0	0	0	0%
Believe Soc.Dist.?	1	1	1	1	1	100%
Heard Soc. Dist. before COVID-19?	0	1	0	0	0	80%
Q1 - before	1	1	1	1	1	100%
Q2 - before	0	1	0	0	1	40%
Q3 - before	1	1	1	1	1	100%
Q4 - before	1	1	1	1	1	100%
Q1 - after	1	1	1	1	1	100%
Q2 - after	0	1	0	0	1	40%
Q3 - after	0	1	1	1	1	80%
Q4 - after	1	1	1	1	1	100%
Overall Effectiveness of website	No response	No response	4	4	5	4.33 out of 5

Discussion

Our learning and plans for next steps discussed by sections:

Section 1 (introduction on Covid-19's exponential growth):

Looking at the responses to the introduction's pre and post test questions, it appears that this section needs to be made clearer. The proportion of users who got questions right in the pre-test stayed the same for the first two questions, and actually decreased for questions 3. What this tells us is that our visualizations and text explanations are failing to convey our message clearly and may actually be confusing readers.

The low percentage of correct responses, 40% correct, to question 2 of the post-test:

- Approximately how long do you think it took for the number of confirmed Covid-19 cases in the United States to go from 200 to 200,000?

shows that the introduction is failing to help users understand how quickly Covid-19 spread in the United states. Interviews with study participants also showed that they found the website to be too text heavy, which suggests that our site's information should be streamlined and made easier to read. In order to improve this section, we will have to take another look at our introductory text and find ways to make our takeaways clearer to the audience. It may also help to find different visualizations that are easier to read and understand to better convey our message.

Section 2 (timeliness of social distancing)

Users have generally expressed some lack of motivation in playing with the first interactive visualization. Even after being encouraged to interact, they seemed to feel lost and hesitant about where to start and what to look for or should get from the graphs. In this light, we plan to add clearer step-by-step guidelines to instruct users to interact with the viz and nudge them to use graphs to better understand the alongside text messages.

Additionally, users have also exhibited concerns about our heavy/lengthy paragraphs throughout the section. While we have many important messages to convey, we also plan to change the text format in the future, such as using text bold and colors to highlight the key words/sentences. We hope to use this to better retain users' attention while reading and making sure they won't miss important information.

In terms of the visualizations, we realized that the inconsistent use of x axis in the 3x3 grid line graphs causes much confusion to our users, and we plan to adjust the x axis for all 9 graphs to make them consistent with each other for further comparisons.

Section 3 (use a simulitis to show how we can slow the viral spread)

There was a bug in the simulitis that would actually crash the site when users play with the sliders. Additionally the task and the need to interact with the simulitis seemed less obvious

when the faded curve disappears at the bottom after a restart of the simulitis. Additional step-by-step guidance on how to interact with the simulitis would be helpful.

General comments:

- Overall narrative and section breakdowns are logical
- Consistent of font, formats and color scheme were good except for the conclusion section
- Text can be better formatted to highlight key words and main points
- Would be great to have additional resources to refer to in conclusion portion that audience can take action with

Links to visualization

https://zheng100.github.io/InfoViz_Sp20Site/

Contribution Table

Project Component	Thyne Boonmark	Wenqi Luo	Hongyang Zheng
Data Preprocessing	40%	60%	0%
Analytics and EDA	50%	50%	0%
Tableau Visualization	40%	40%	20%
Interactive Visualization	5%	5%	90%
Website overall design/layout	25%	25%	50%
Website Implement Section 1	90%	0%	10%
Website Implement Section 2	10%	80%	10%
Website Implement Section 3	20%	0%	80%
Usability Test	35%	40%	25%
Report writeup	45%	45%	10%

Appendix

References

Articles:

https://covidvis.berkeley.edu/

https://blog.supplysideliberal.com/post/2020/4/2/logarithms-and-cost-benefit-analysis-applied-to-the-coronavirus-crisis

https://www.businessinsider.com/coronavirus-contagious-r-naught-average-patient-spread-2020-3

https://www.washingtonpost.com/graphics/2020/world/corona-simulator/

https://www.3blue1brown.com/videos-blog/exponential-growth-and-epidemics

https://www.nytimes.com/interactive/2020/world/coronavirus-maps.html

https://www.pbs.org/newshour/show/the-dangerous-global-flood-of-misinformation-surrounding-covid-19

https://www.nytimes.com/interactive/2020/us/coronavirus-stay-at-home-order.html

https://www.datacat.cc/covid/

Repo, notebook and Code References:

https://templated.co/spatial

Github Repo (data, tableau files): https://github.com/thyneb19/InfoViz-Final-Project

Github Repo (website): https://github.com/zheng100/InfoViz_Sp20Site

Observable notebook:
https://observablehq.com/@zheng100/infovis-final-project-social-distance-simulation-_v7

Final Project Website: https://zheng100.github.io/InfoViz_Sp20Site/

Usability Test Questionnaire - Social Distancing

Thank you for your time to participate for this usability test. Before we get started, we want to collect some quick information about you and answer a few question on your knowledge about Social distancing.

Section1:

- Which age group do you belong to?
    A. 0 -17
    B. 18 to 40
    C. 41 to 65
    D. Over 65

- Have you had prior experience in Web Design, User Experience Design, Data Visualization Design?
    A. Yes
    B. No

- Have you had prior experience in Web Design, User Experience Design, Data Visualization Design?
    A. Yes
    B. No

- Do you believe the concept of social distancing?
    A. Yes
    B. No

- Have you heard about social distancing before the outbreak of COVID - 19?
    A. Yes
    B. No

- What is Covid-19?
    A. Strain of virus that has been previously identified
    B. Strain of virus that has not been previously identified

- Approximately how long do you think it took for the number of confirmed Covid-19 cases in the United States to go from 200 to 200,000?
    A. 1 to 2 weeks
    B. 3 weeks to 1 month
    C. 2 to 3 months
    D. 4 to 6 months
    E. Has not happened yet

- Fill in the blank: The number of deaths per day caused by Covid-19 has grown at a rate _____ the number of deaths per day caused by seasonal pneumonia and influenza in the past.
    A. Slower than
    B. Similar to
    C. Faster than

- Do you think that social distancing should be practiced in a timely manner?
    A. Yes
    B. No
    C. I'm not sure.

Section2

- Now Please use the link below to access our site https://zheng100.github.io/InfoViz_Sp20Site/

Section3

- What is Covid-19?
    A. Strain of virus that has been previously identified
    B. Strain of virus that has not been previously identified

- Approximately how long do you think it took for the number of confirmed Covid-19 cases in the United States to go from 200 to 200,000?
    A. 1 to 2 weeks
    B. 3 weeks to 1 month
    C. 2 to 3 months
    D. 4 to 6 months
    E. Has not happened yet

- Fill in the blank: The number of deaths per day caused by Covid-19 has grown at a rate _____ the number of deaths per day caused by seasonal pneumonia and influenza in the past.
    A. Slower than
    B. Similar to
    C. Faster than

- Do you think that social distancing should be practiced in a timely manner?
    A. Yes
    B. No
    C. I'm not sure.

Section4

General Feedback (for semi-structured interview)

- Did you feel like you learned something new? If so, what is it?
- Is there anything about the graphs that you found confusing or particularly hard to understand?
- Is there anything you found missing/irrelevant in the current website?
- Overall, how would you rate the effectiveness of the website in informing you about Covid-19 and social distancing policies?
    - Likert scale from 1 to 5. 1 meaning very poor, 5 meaning very effective

Consent Forms:

Before including participants into our usability study, we received their informed consent via the following form.

STATEMENT OF INFORMED CONSENT

A group of graduate students at UC Berkeley are conducting studies to assess the effectiveness of design of social distancing site. The graduate students are Hongyang Zheng, Thyne Boonmark, Wenqi Luo.

If you volunteer to participate in this study, you will be asked to use a computer system to access the social distancing site, and to answer some questions. You will be asked to fill out a written questionnaire after the final activity.

There are no benefits to you for participating, other than what may be an educational experience in using some new technologies for social distancing. We hope that the research will benefit society by improving people's understanding of the need of social distance and the danger of exponential growth. This research poses no risks to you other than those normally encountered in daily life.

We will not name you if and when we discuss your behavior in research publications. After the research is completed, we may save the notes for future use by ourselves or others. However, this same confidentiality guarantees given here will apply to future storage and use of the materials.

Your participation in this research is voluntary, and you are free to refuse to participate or quit the experiment at any time. Whether or not you chose to participate will have no bearing in relation to your standing in any department of UC Berkeley. If you have questions about the research, you may contact Professor Marti Hearst by electronic mail hearst@berkeley.edu. You may keep a copy of this form for reference.

If you accept these terms, please write your initials and the date here: