Computer Programming Fundamentals

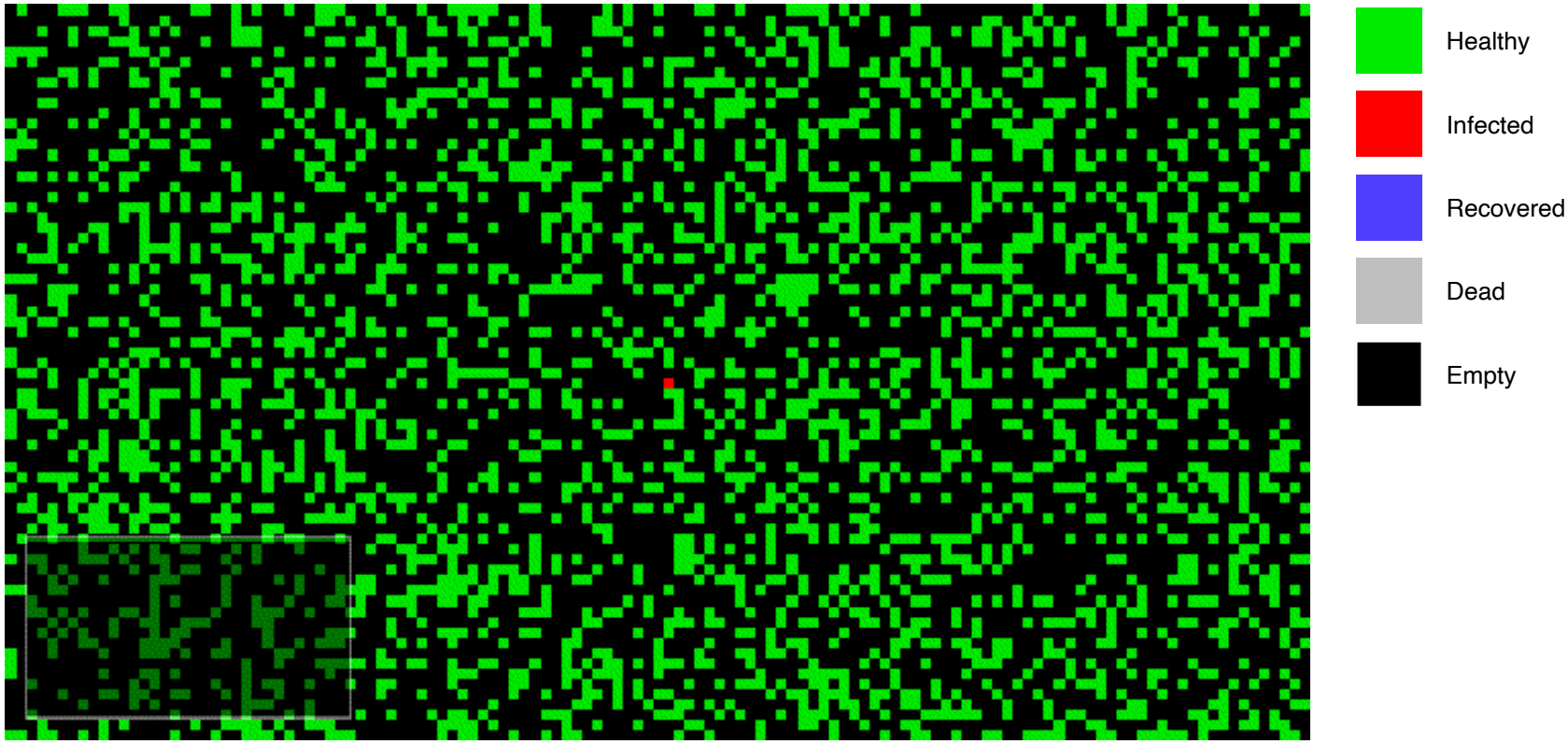
CS 152
Professor: Leah Buechley
TAs: Melody Horn, Noah Garcia, Andrew Geyko, Juan Ormaza
Time: MWF 10:00-10:50am
https://handandmachine.cs.unm.edu/classes/CS152_Fall2021/

WHERE WE ARE IN TERM

CELLULAR AUTOMATA WRAP UP

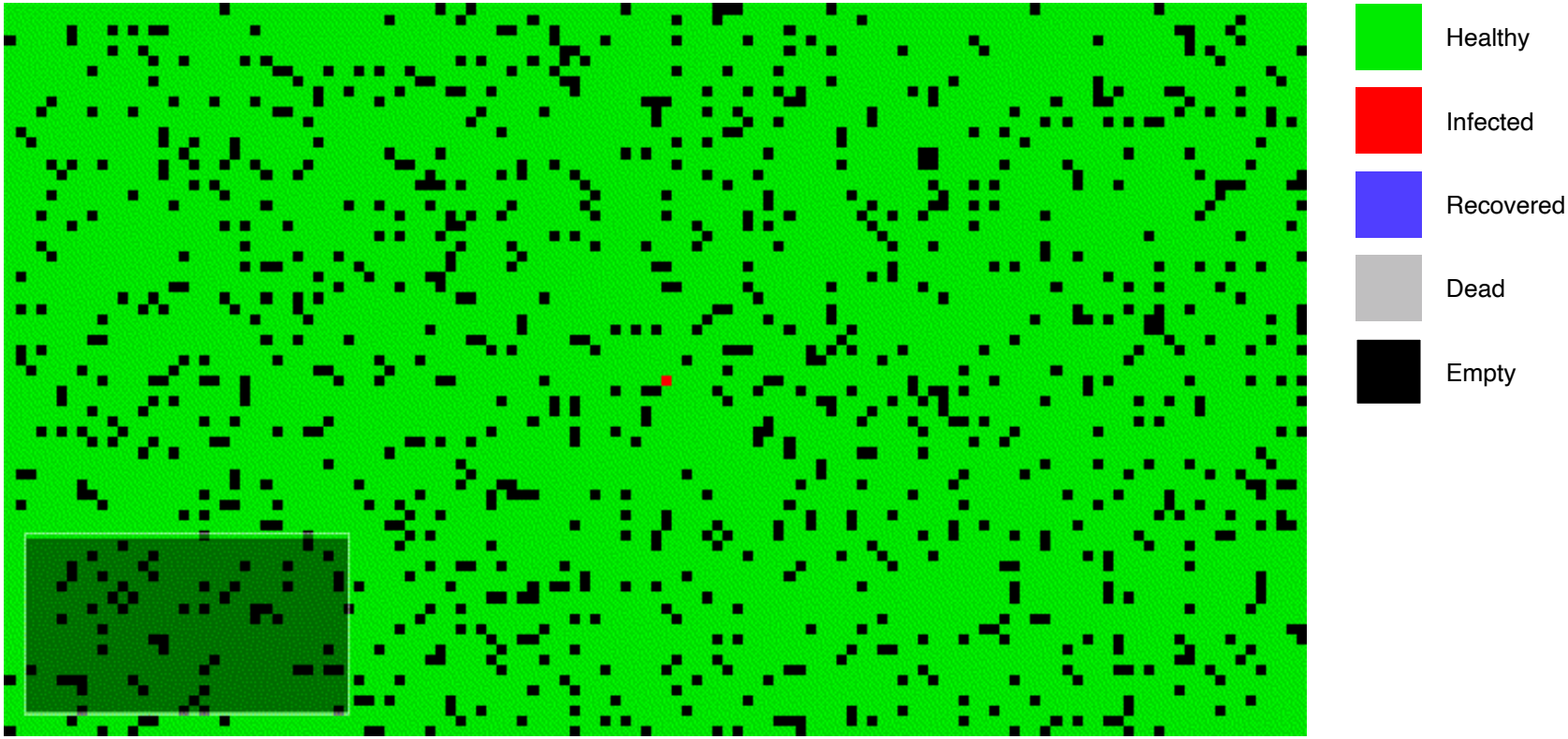
WHY ARE CA INTERESTING AND RELEVANT?

COVID-19 Simulation



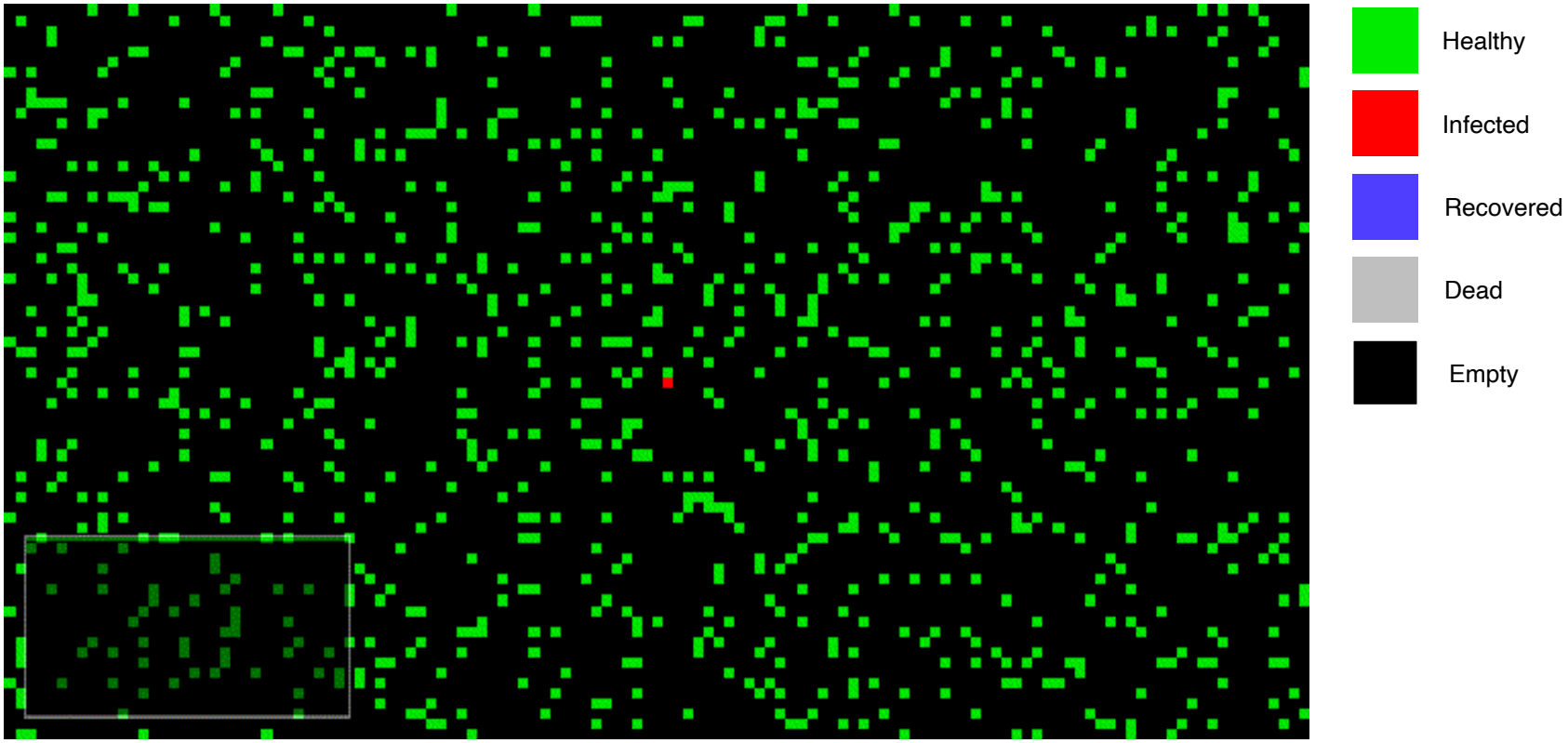
by Jason Rampe: https://softologyblog.wordpress.com/2020/03/23/pandemic-simulations/

Higher population density



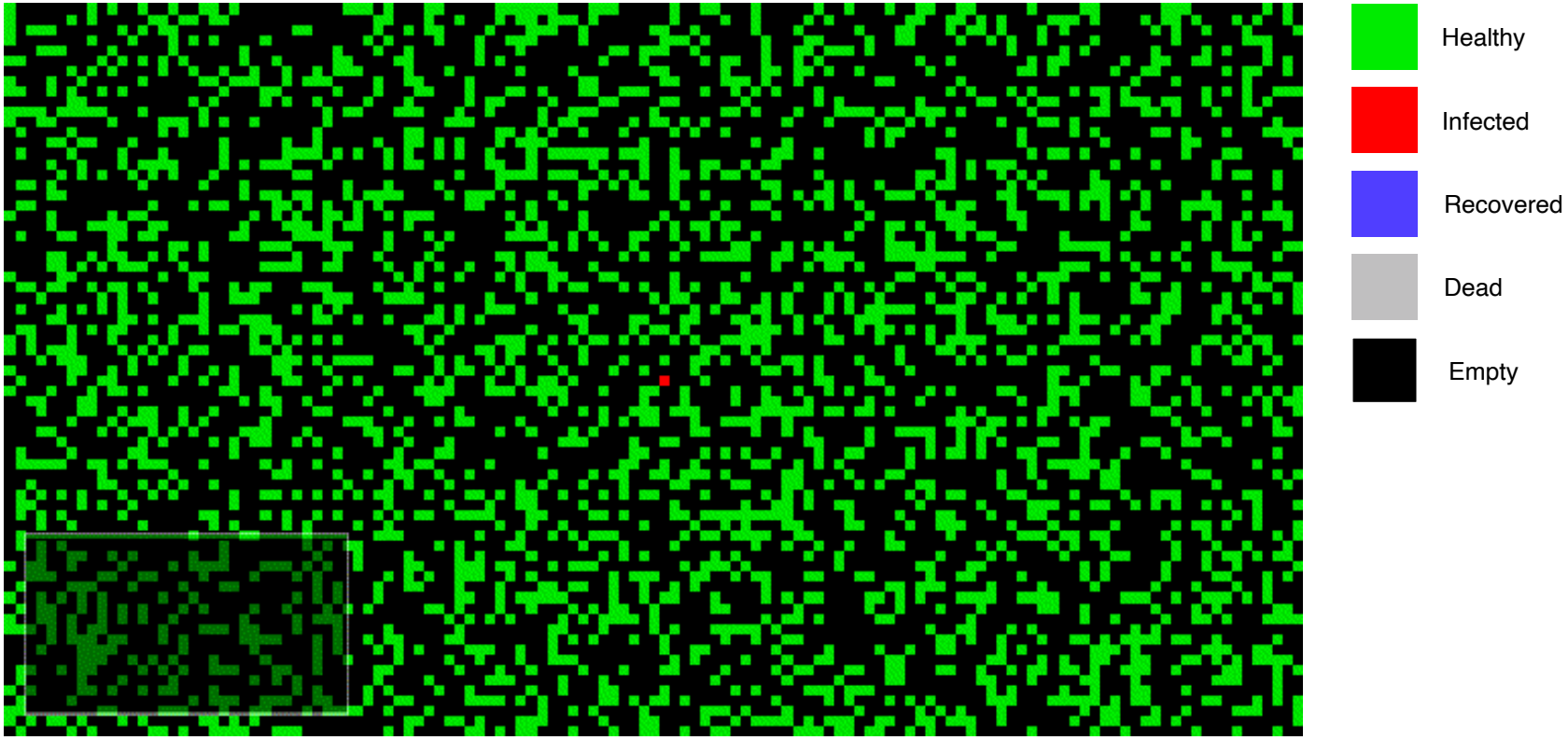
by Jason Rampe: https://softologyblog.wordpress.com/2020/03/23/pandemic-simulations/

Lower population density



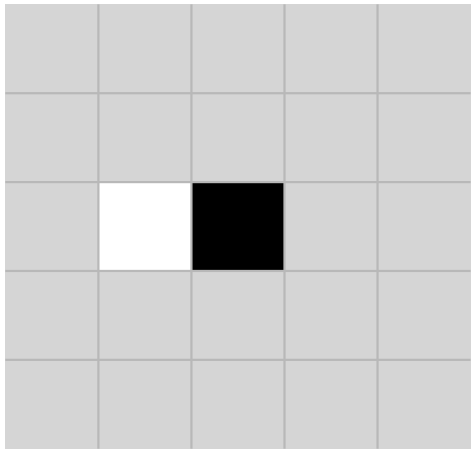
by Jason Rampe: https://softologyblog.wordpress.com/2020/03/23/pandemic-simulations/

Medium density, less likely to travel

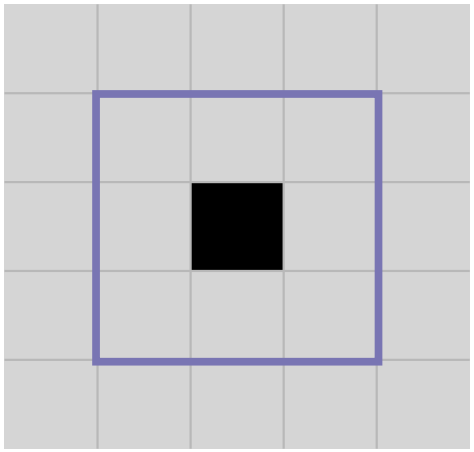


by Jason Rampe: https://softologyblog.wordpress.com/2020/03/23/pandemic-simulations/

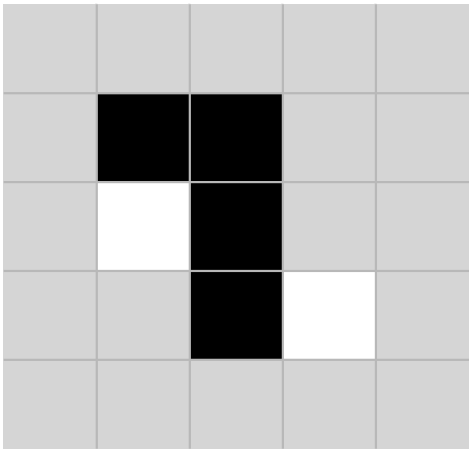
The Schelling Model



States: black
white
empty (grey)

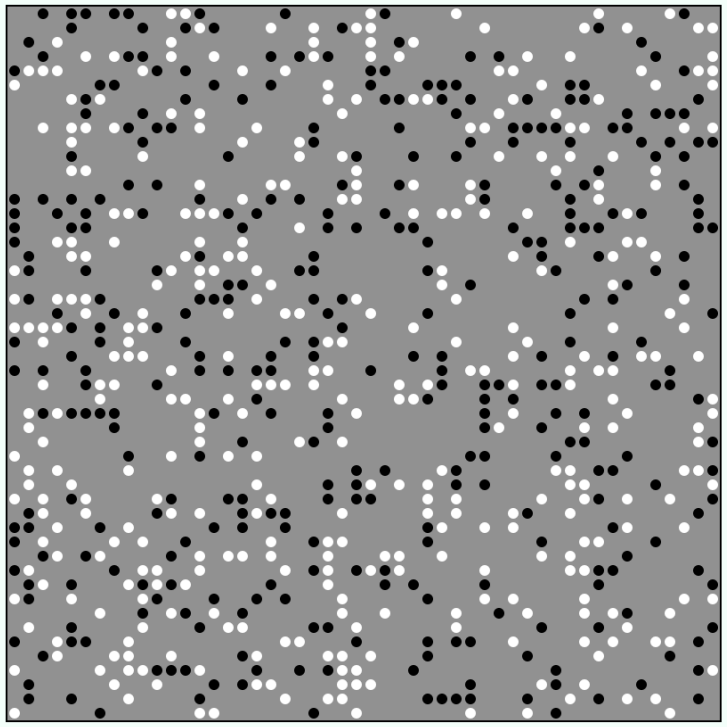


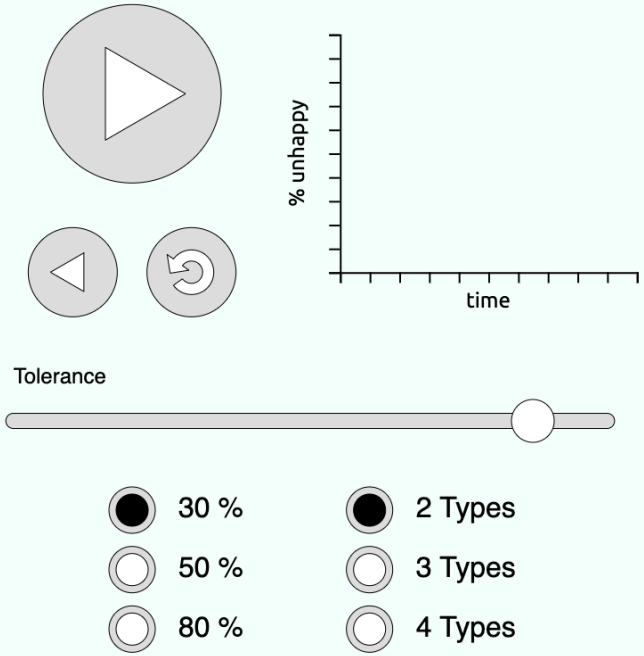
Neighborhood



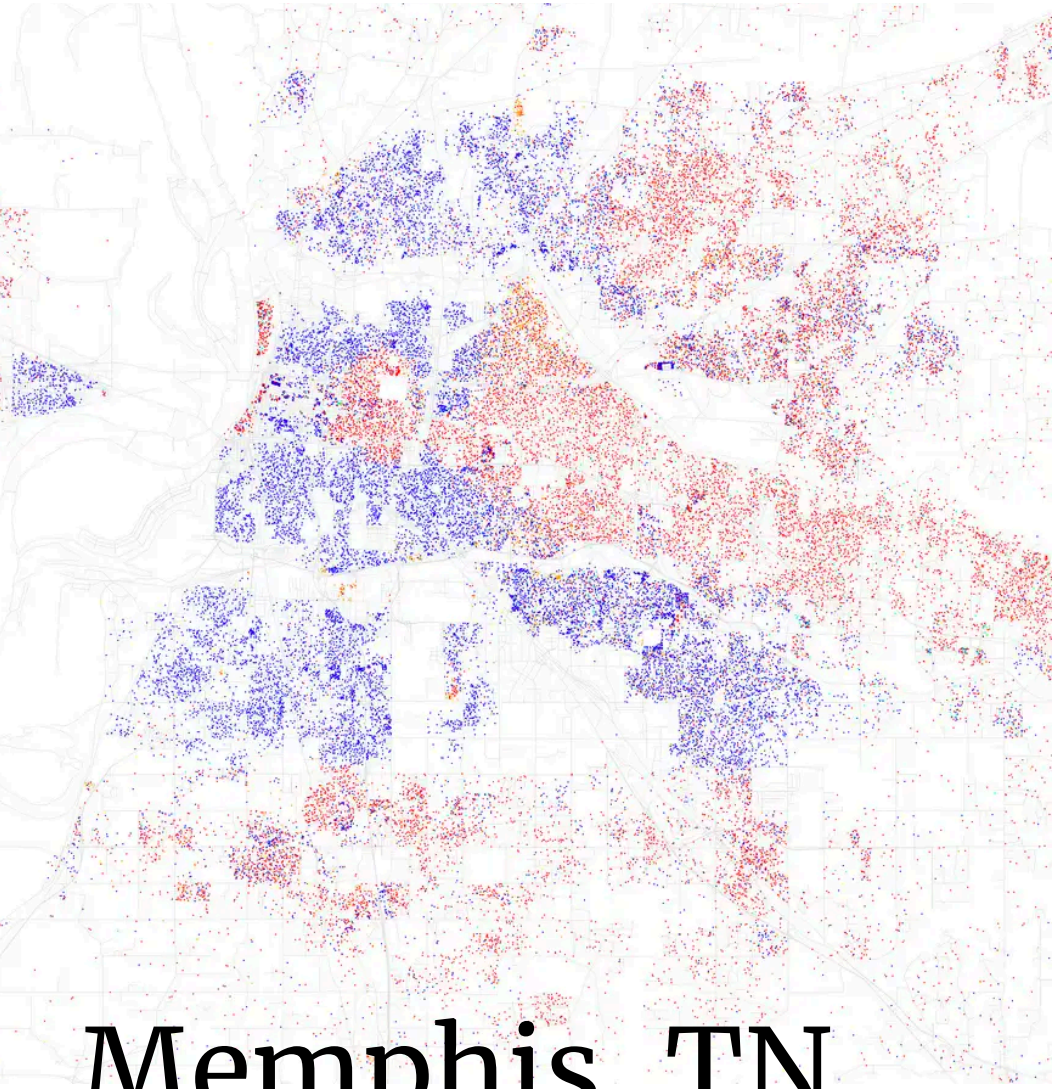
Rule:
If more than 1/3 of my neighbors are a different color than me,
I move to an empty square at a random location.
Otherwise, I stay where I am.

The Schelling model





https://www.complexity-explorables.org/slides/t-schelling-plays-go/



Memphis, TN

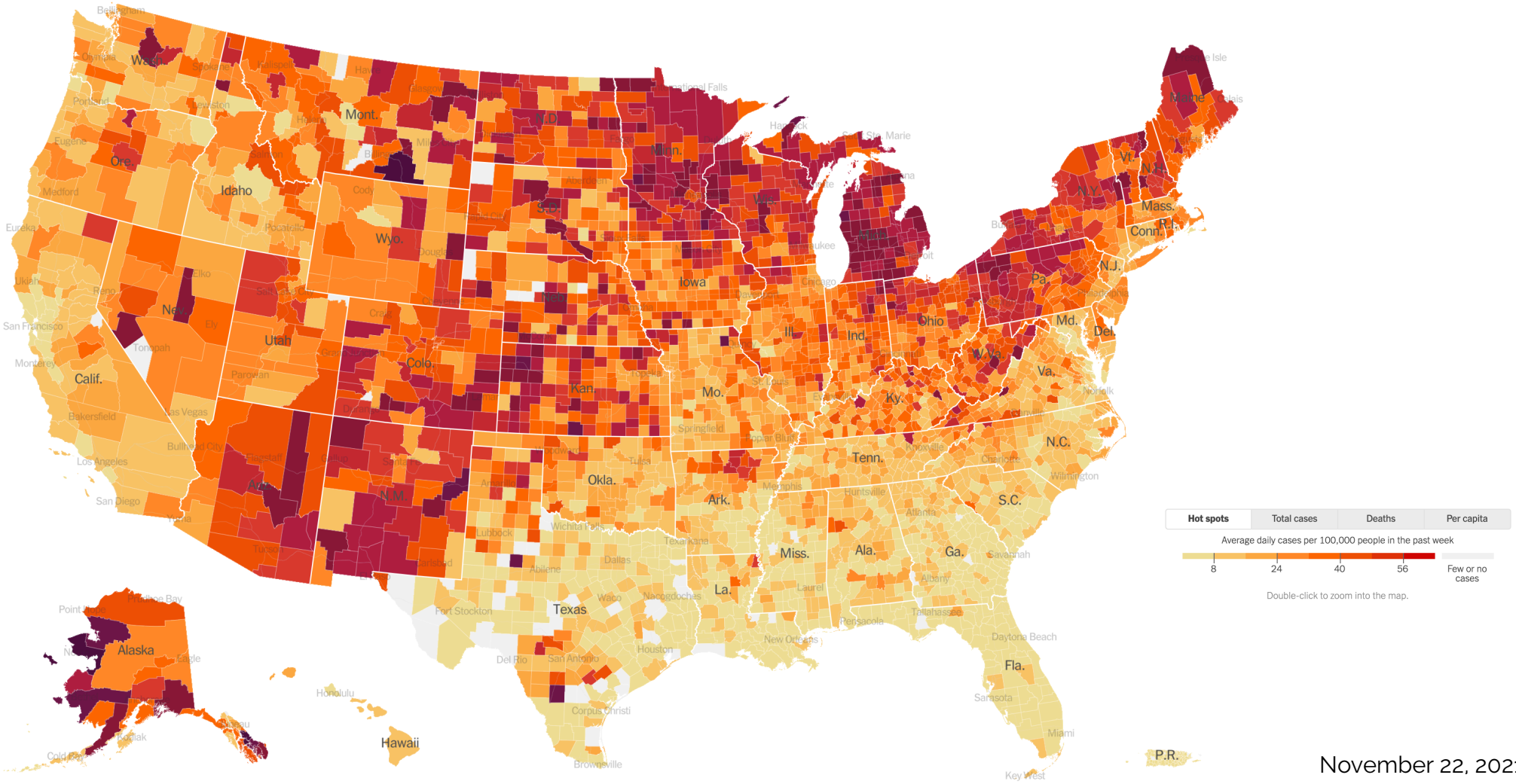
Pittsburg, PA

https://www.businessinsider.com/most-segregated-cities-census-maps-2013-4

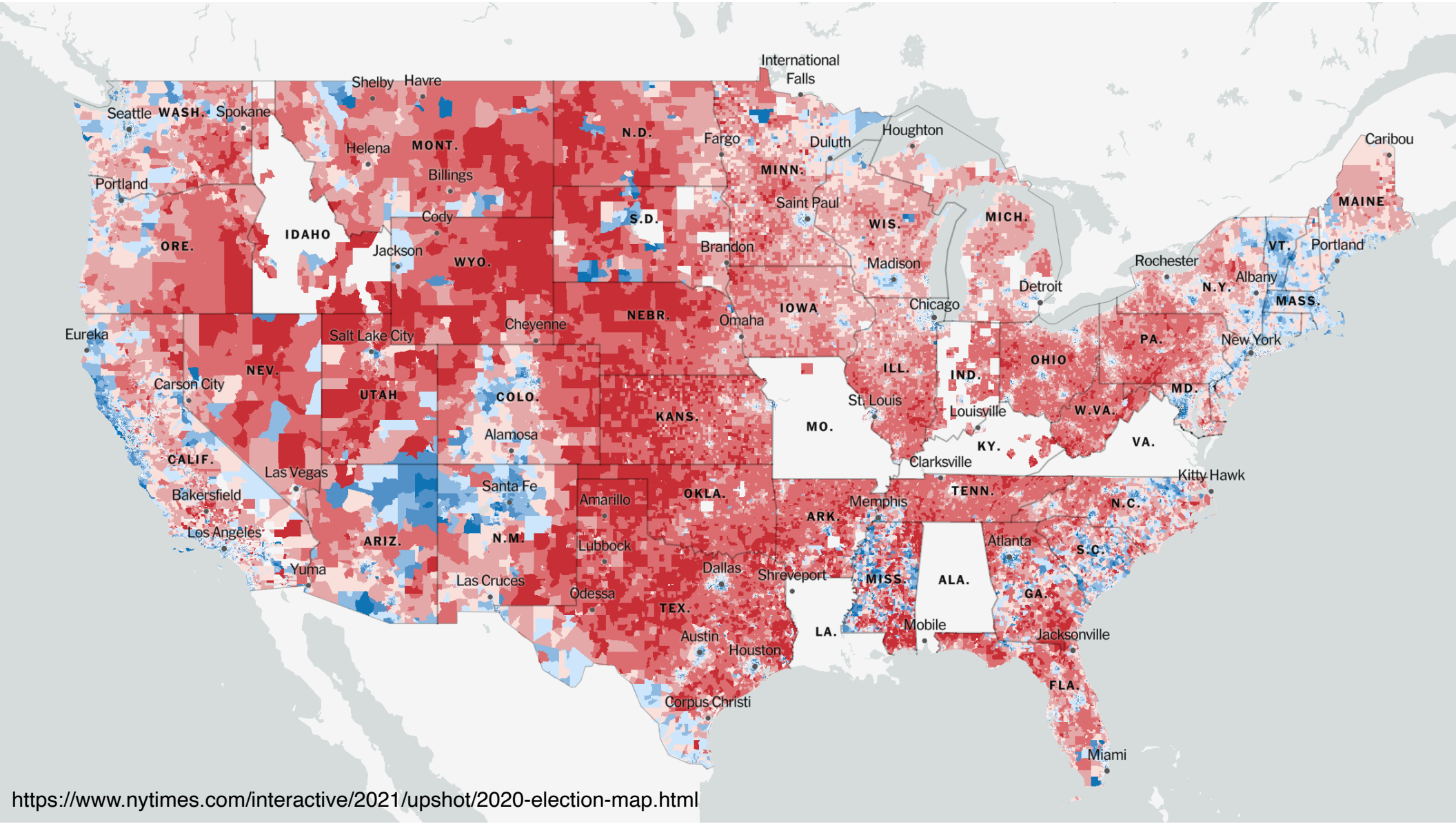
NEW TOPIC:
DATA & DATA VISUALIZATION

MAKING SENSE OF THE WORLD

Coronavirus in the U.S.: Latest Map and Case Count



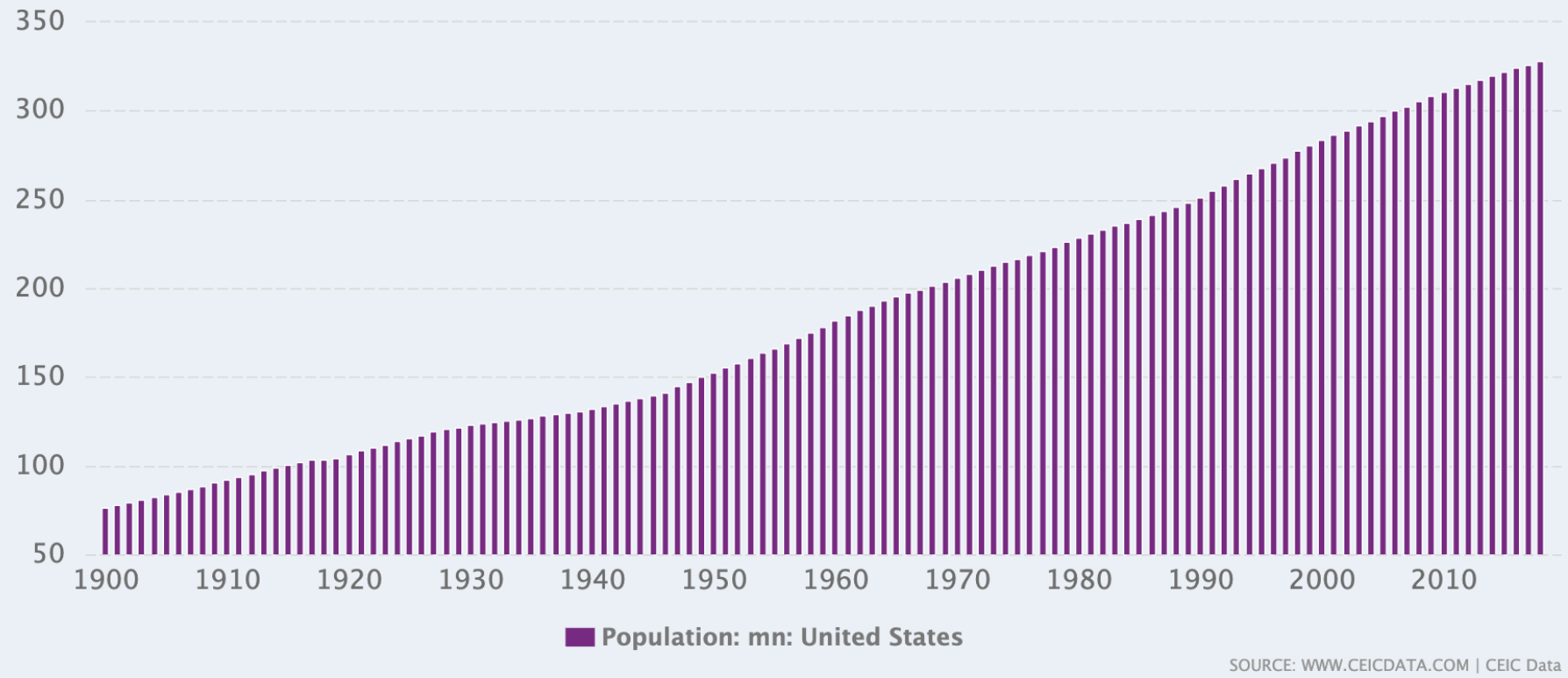
November 22, 2021

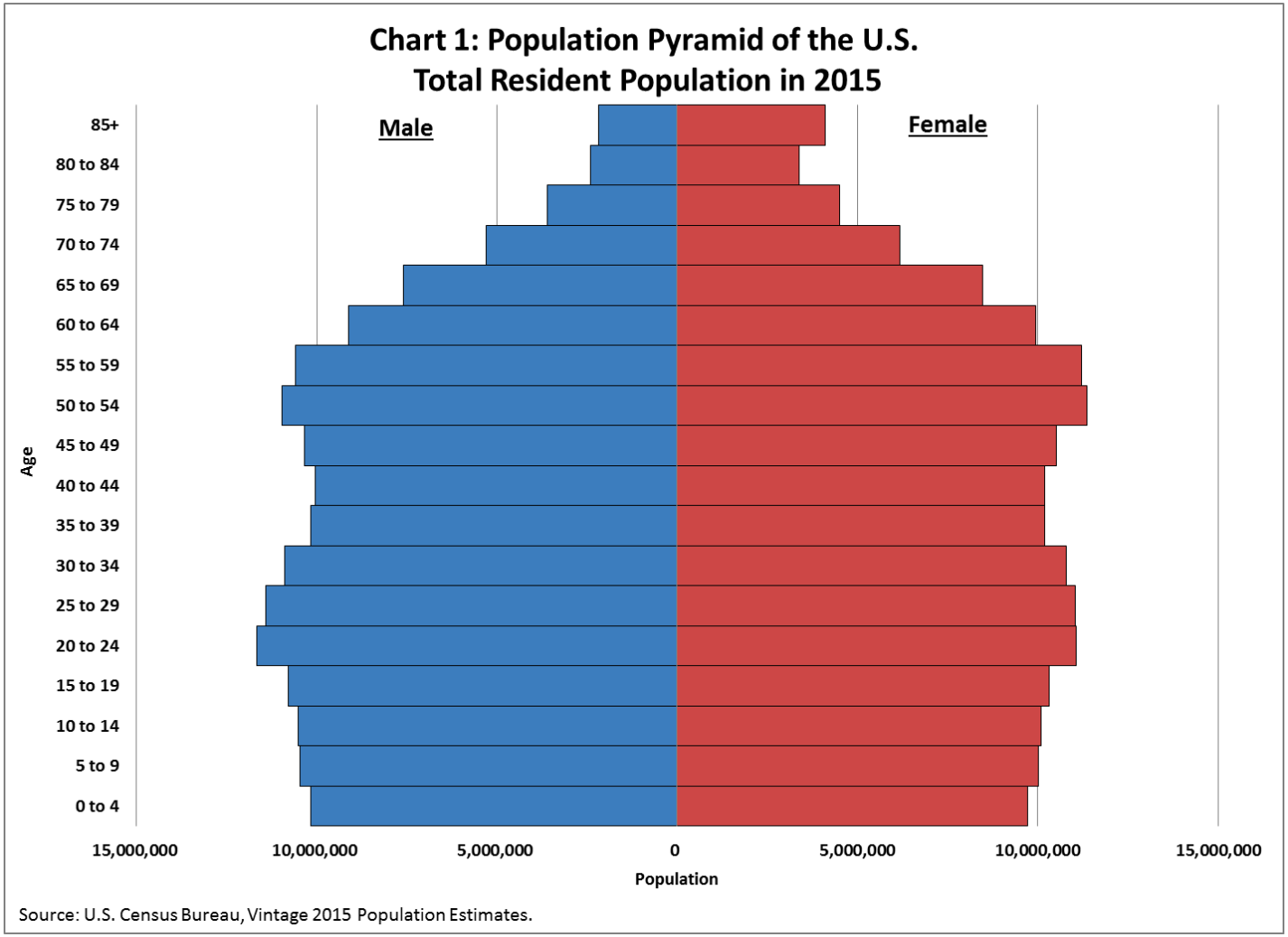


https://www.nytimes.com/interactive/2021/upshot/2020-election-map.html

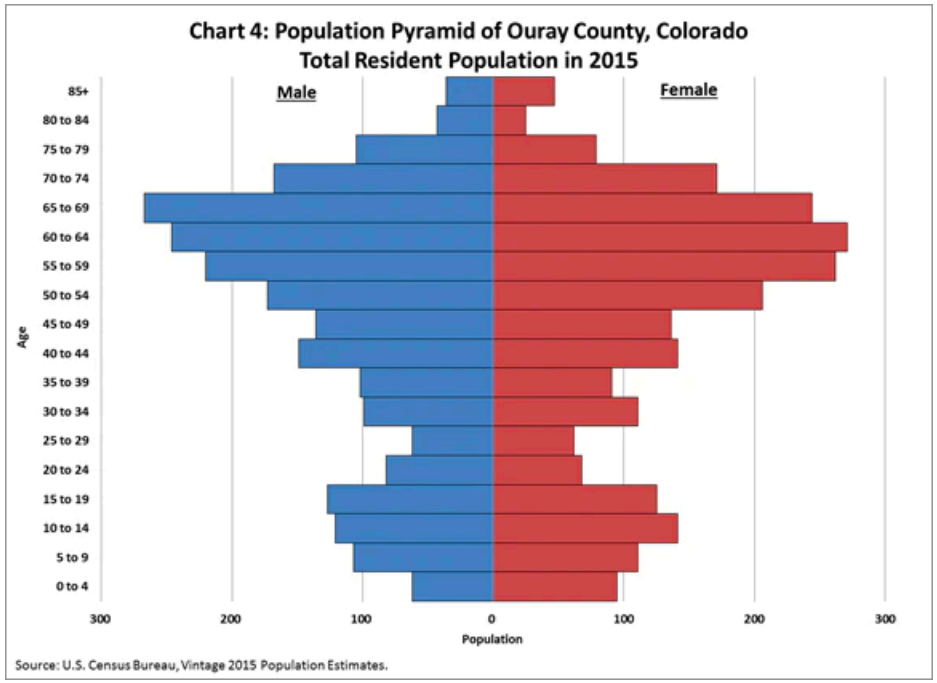
DATA TELLS STORIES

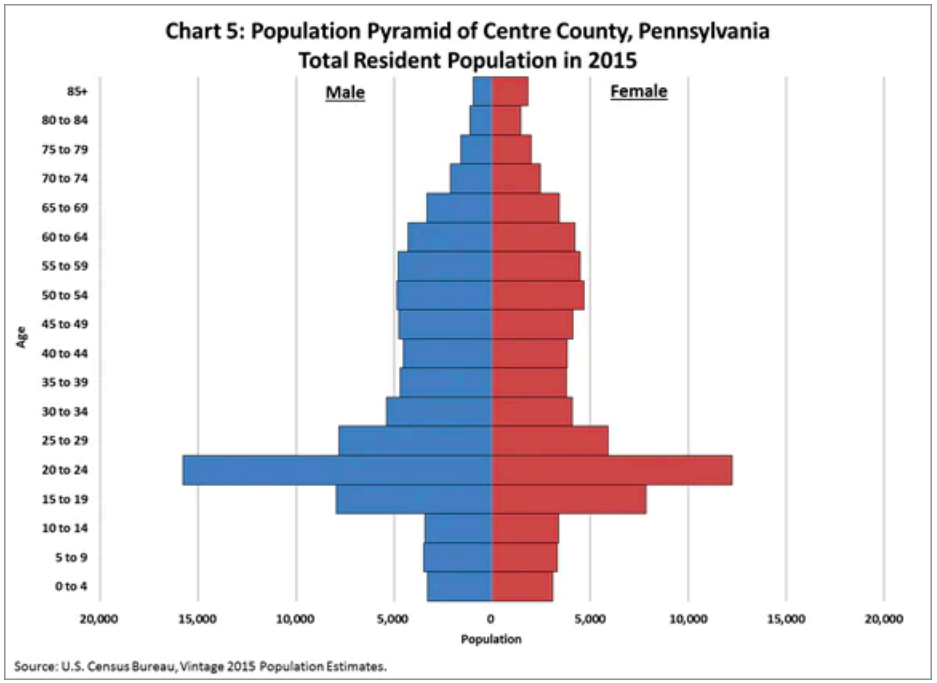
United States's Population from 1900 to 2020





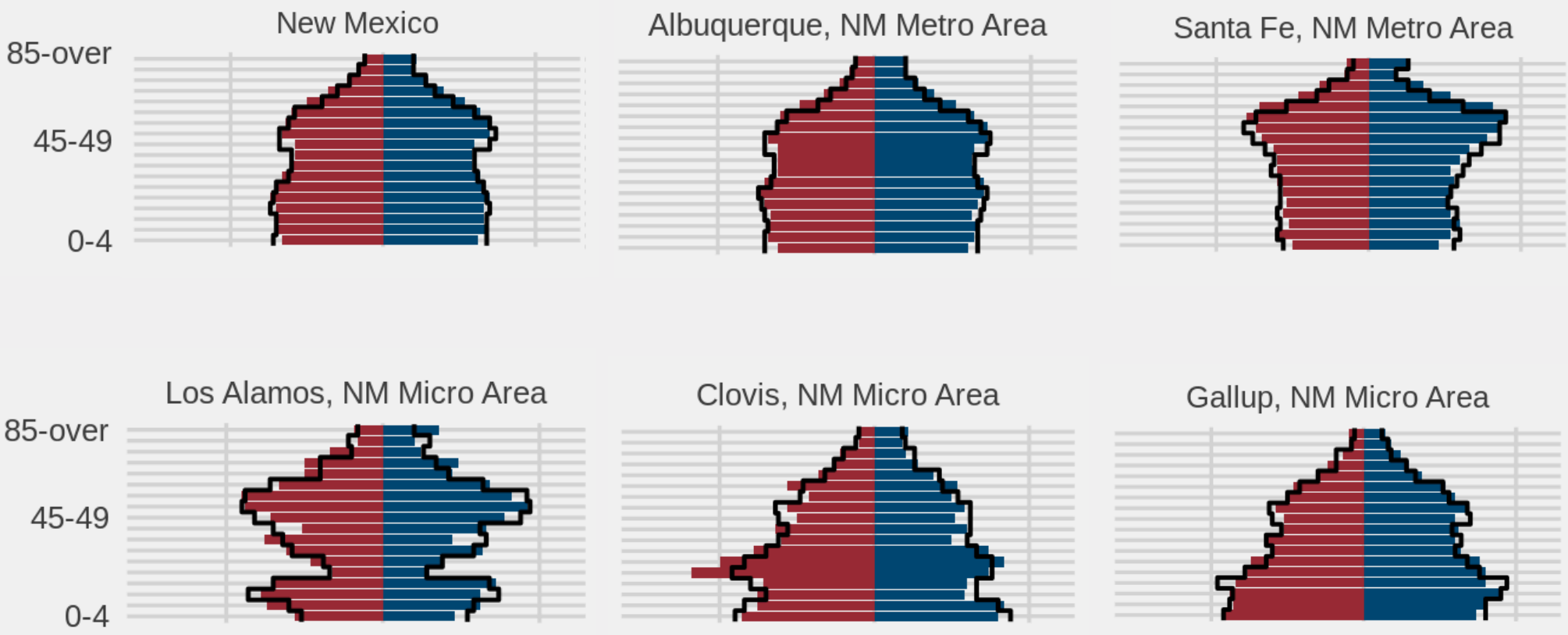
https://www.census.gov/newsroom/blogs/random-samplings/2016/06/americas-age-profile-told-through-population-pyramids.html





retirement destination

Penn State University



https://www.jtimm.net/2018/03/29/historical-socio-demographic-profiles/

TODAY: WORKING WITH DATA

TODAY: EXPLORING ALBUQUERQUE WEATHER

WE WANT TO

- Import data from a csv file
- Parse data
- Store data in an array
- Graph data
- Analyze data

CREATE A NEW PROJECT:
Week14

CREATE A NEW PROJECT:
Week14

Download this sample data file:

https://handandmachine.cs.unm.edu/classes/CS152_Fall2021/sampleCode/abqweather.csv

source: https://www.ncei.noaa.gov/maps/lcd/

MOVE TO Week14 DIRECTORY

WHAT IS IN THE FILE?
WHERE DID THE DATA COME FROM?

NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Home | Climate Information | Data Access | Customer Support | Contact | About | Search

Home > Climate Data Online | Datasets | Search Tool | Mapping Tool | Data Tools | Help

Climate Data Online

Climate Data Online (CDO) provides free access to NCDC's archive of global historical weather and climate data in addition to station history information. These data include quality controlled daily, monthly, seasonal, and yearly measurements of temperature, precipitation, wind, and degree days as well as radar data and 30-year Climate Normals. Customers can also order most of these data as certified hard copies for legal use.

Browse Datasets
Browse documentation, samples, and links

Certify Orders
Get orders certified for legal use (requires payment)

Check Status
Check the status of an order that has been placed

Find Help
Find answers to questions about data and ordering

https://www.ncdc.noaa.gov/cdo-web/

Hourly temperature (°F) and humidity (%) readings for a week in November

date	temperature	humidity
2021-11-11T00:52:00	47	34
2021-11-11T01:52:00	44	35
2021-11-11T02:00:00	44	35
2021-11-11T02:52:00	44	34
2021-11-11T03:52:00	45	35
2021-11-11T04:52:00	44	37
2021-11-11T05:00:00	44	37
2021-11-11T05:52:00	42	40
2021-11-11T06:52:00	41	41
2021-11-11T07:52:00	45	37
2021-11-11T08:00:00	45	37
2021-11-11T08:52:00	49	33
2021-11-11T09:52:00	51	31
2021-11-11T10:52:00	54	28
2021-11-11T11:00:00	54	28
2021-11-11T11:52:00	57	24
2021-11-11T12:38:00	59	19

File opened in Excel

date	temperature	humidity
2021-11-11T00:52:00	47	34
2021-11-11T01:52:00	44	35
2021-11-11T02:00:00	44	35
2021-11-11T02:52:00	44	34
2021-11-11T03:52:00	45	35
2021-11-11T04:52:00	44	37
2021-11-11T05:00:00	44	37
2021-11-11T05:52:00	42	40
2021-11-11T06:52:00	41	41
2021-11-11T07:52:00	45	37
2021-11-11T08:00:00	45	37
2021-11-11T08:52:00	49	33
2021-11-11T09:52:00	51	31
2021-11-11T10:52:00	54	28
2021-11-11T11:00:00	54	28
2021-11-11T11:52:00	57	24
2021-11-11T12:38:00	59	19
2021-11-11T12:52:00	60	18

File opened in Notepad or TextEdit

```
date,temperature,humidity
2021-11-11T00:52:00,47,34
2021-11-11T01:52:00,44,35
2021-11-11T02:00:00,44,35
2021-11-11T02:52:00,44,34
2021-11-11T03:52:00,45,35
2021-11-11T04:52:00,44,37
2021-11-11T05:00:00,44,37
2021-11-11T05:52:00,42,40
2021-11-11T06:52:00,41,41
2021-11-11T07:52:00,45,37
2021-11-11T08:00:00,45,37
2021-11-11T08:52:00,49,33
2021-11-11T09:52:00,51,31
2021-11-11T10:52:00,54,28
2021-11-11T11:00:00,54,28
2021-11-11T11:52:00,57,24
2021-11-11T12:38:00,59,19
2021-11-11T12:52:00,60,18
```

FILE TYPE = CSV

CSV = “Comma Separated Value”

a simple and common format for data

commas separate columns of data

carriage returns separate rows of data

the file is just a simple text file and can be opened with any text editing program

questions?

BACK TO OUR PROGRAM

CREATE A NEW PROJECT:
Week14

DOWNLOAD BasicPanel.jar
ADD AS A LIBRARY

CREATE A DataVisualization.java FILE

DataVisualization.java

```
public class DataVisualization {

}
```

WE'LL BE USING THE Scanner FUNCTIONALITY WE USED IN WEEK 4

https://www.w3schools.com/java/java_user_input.asp

https://www.w3schools.com/java/java_files_read.asp

WE'LL GET DATA FROM A FILE INSTEAD OF FROM USER INPUT

REVIEW

ADD A MAIN METHOD

```
public class DataVisualization {

    public static void main(String[] args) {

    }

}
```

SCANNING FOR USER INPUT

```
import java.util.Scanner;

public class DataVisualization {

    public static void main(String[] args) {
        Scanner scan = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int number = scan.nextInt();
        System.out.println("you entered: " +number);
    }

}
```

SCAN DATA FROM A FILE

ADD AN IMPORT STATEMENT

```
import java.util.Scanner;
import java.io.File;

public class DataVisualization {

    public static void main(String[] args) {
        Scanner scan = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int number = scan.nextInt();
        System.out.println("you entered: " +number);
    }

}
```

library for working with files

ADD AN importData METHOD

```
static void importData() {

}
```

importData METHOD

```
static void importData() {
    String filename = "abq_weather.csv";
    File file = new File(filename);
}
```

define the file where data is located

importData METHOD

```
static void importData() {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
}
```

create a scanner that will read from the file

FileNotFoundExecption

```
static void importData() {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
}
```

```
java: unreported exception java.io.FileNotFoundException; must be caught or declared to be thrown
```

means bad things can happen if the program can't find the abq_weather.csv file

Java forces you to deal with these problems (or at least acknowledge them) in your program

ACKNOWLEDGING THE PROBLEM

```
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
}
```

questions?

READING DATA FROM A FILE

- The data is read in as text, as Strings
- The data is read in line by line
- We don't know how big the file is (how many lines/ rows the files has) until we open it and read it

- We want to read in the data and store temperature and humidity in a 2D array of integers

WHAT THE DATA LOOKS LIKE

```
date,temperature,humidity
2021-11-11T00:52:00,47,34
2021-11-11T01:52:00,44,35
2021-11-11T02:00:00,44,35
2021-11-11T02:52:00,44,34
2021-11-11T03:52:00,45,35
2021-11-11T04:52:00,44,37
2021-11-11T05:00:00,44,37
2021-11-11T05:52:00,42,40
2021-11-11T06:52:00,41,41
2021-11-11T07:52:00,45,37
2021-11-11T08:00:00,45,37
2021-11-11T08:52:00,49,33
2021-11-11T09:52:00,51,31
2021-11-11T10:52:00,54,28
2021-11-11T11:00:00,54,28
2021-11-11T11:52:00,57,24
2021-11-11T12:38:00,59,19
2021-11-11T12:52:00,60,18
```

READING THE DATA & PRINTING IT

```
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";

}
```

line variable will hold text from each line

READING THE DATA & PRINTING IT

```
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    while (scan.hasNext()) {

    }
}
```

hasNext() method:

returns true if there is data left in the file

returns false if the end of the file has been reached

READING THE DATA & PRINTING IT

```
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
    }
}
```

nextLine() method:

returns the next line in the file as a string

questions?

CALLING OUR METHOD IN main

HAVE TO ACKNOWLEDGE EXCEPTION

```
public static void main(String[] args) throws FileNotFoundException {

}
```

EDIT main

```
public static void main(String[] args) throws FileNotFoundException {
    importData();
}
```

```
2021-11-17T15:52:00,62,17
2021-11-17T16:52:00,60,18
2021-11-17T17:00:00,60,18
2021-11-17T17:52:00,57,20
2021-11-17T18:52:00,52,32
2021-11-17T19:52:00,48,36
2021-11-17T20:00:00,48,36
2021-11-17T20:52:00,45,31
2021-11-17T21:52:00,43,31
2021-11-17T22:52:00,42,30
2021-11-17T23:00:00,42,30
2021-11-17T23:52:00,40,33
2021-11-18T00:52:00,39,33
```

questions?