Wk 6 Data Transformation: World Population

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```
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.2     v readr     2.1.4
## v forcats   1.0.0     v stringr   1.5.0
## v ggplot2   3.4.3     v tibble    3.2.1
## v lubridate 1.9.2     v tidyr     1.3.0
## v purrr     1.0.1
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

#In this data set we will looking at a data set containing global population counts for 234 countries or territories. I want to compare growth rates among continents and zoom in on growth rates in Asian and African countries.

Read in the untidy .csv file from github

```
url <- "https://raw.githubusercontent.com/D-hartog/DATA607/main/PROJECT2/worldpop_untidy.csv"

world_pop <- read_csv(url)
```

```
## Rows: 234 Columns: 17
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (4): CCA3, Country/Territory, Capital, Continent
## dbl (13): Rank, 2022 Population, 2020 Population, 2015 Population, 2010 Popu...
##
## i Use ‘spec()‘ to retrieve the full column specification for this data.
## i Specify the column types or set ‘show_col_types = FALSE‘ to quiet this message.
```

```
head(world_pop)
```

```
## # A tibble: 6 x 17
##    Rank CCA3  ‘Country/Territory‘ Capital          Continent ‘2022 Population‘
##   <dbl> <chr> <chr>               <chr>            <chr>                 <dbl>
## 1    36 AFG   Afghanistan         Kabul            Asia               41128771
## 2   138 ALB   Albania            Tirana           Europe              2842321
## 3    34 DZA   Algeria            Algiers          Africa             44903225
## 4   213 ASM   American Samoa     Pago Pago        Oceania               44273
## 5   203 AND   Andorra            Andorra la Vella Europe                79824
## 6    42 AGO   Angola             Luanda           Africa             35588987
## # i 11 more variables: ‘2020 Population‘ <dbl>, ‘2015 Population‘ <dbl>,
## #   ‘2010 Population‘ <dbl>, ‘2000 Population‘ <dbl>, ‘1990 Population‘ <dbl>,
## #   ‘1980 Population‘ <dbl>, ‘1970 Population‘ <dbl>, ‘Area (km²)‘ <dbl>,
## #   ‘Density (per km²)‘ <dbl>, ‘Growth Rate‘ <dbl>,
## #   ‘World Population Percentage‘ <dbl>
```

```
glimpse(world_pop)
```

```
## Rows: 234
## Columns: 17
## $ Rank                          <dbl> 36, 138, 34, 213, 203, 42, 224, 201, 33,~
## $ CCA3                          <chr> "AFG", "ALB", "DZA", "ASM", "AND", "AGO"~
## $ ‘Country/Territory‘           <chr> "Afghanistan", "Albania", "Algeria", "Am~
## $ Capital                       <chr> "Kabul", "Tirana", "Algiers", "Pago Pago~
## $ Continent                     <chr> "Asia", "Europe", "Africa", "Oceania", "~
## $ ‘2022 Population‘             <dbl> 41128771, 2842321, 44903225, 44273, 7982~
## $ ‘2020 Population‘             <dbl> 38972230, 2866849, 43451666, 46189, 7770~
## $ ‘2015 Population‘             <dbl> 33753499, 2882481, 39543154, 51368, 7174~
## $ ‘2010 Population‘             <dbl> 28189672, 2913399, 35856344, 54849, 7151~
## $ ‘2000 Population‘             <dbl> 19542982, 3182021, 30774621, 58230, 6609~
## $ ‘1990 Population‘             <dbl> 10694796, 3295066, 25518074, 47818, 5356~
## $ ‘1980 Population‘             <dbl> 12486631, 2941651, 18739378, 32886, 3561~
## $ ‘1970 Population‘             <dbl> 10752971, 2324731, 13795915, 27075, 1986~
## $ ‘Area (km²)‘                  <dbl> 652230, 28748, 2381741, 199, 468, 124670~
## $ ‘Density (per km²)‘           <dbl> 63.0587, 98.8702, 18.8531, 222.4774, 170~
## $ ‘Growth Rate‘                 <dbl> 1.0257, 0.9957, 1.0164, 0.9831, 1.0100, ~
## $ ‘World Population Percentage‘ <dbl> 0.52, 0.04, 0.56, 0.00, 0.00, 0.45, 0.00~
```

CLEANING THE DATA

1. First I want to change the column names for later transformtion of the data.

```
colnames(world_pop)[c(1:17)] <- c("RANK","CCAS", "COUNTRY_TERR", "CAPITAL","CONTINENT", "2022", "2020",
```

TIDY/TRANSFORMING THE DATA

1. I don’t think that there is much transfromation that needs to be done to the data execpt taking the year columns pivoting those columns to rows.

```
world_long <- world_pop %>%
  pivot_longer(
    cols = "2022":"1970",
    names_to = "YEAR",
    values_to = "POPULATION"
  )

glimpse(world_long)
```

```
## Rows: 1,872
## Columns: 11
## $ RANK          <dbl> 36, 36, 36, 36, 36, 36, 36, 36, 138, 138, 138, 138, 138,~
## $ CCAS          <chr> "AFG", "AFG", "AFG", "AFG", "AFG", "AFG", "AFG", "AFG", ~
## $ COUNTRY_TERR  <chr> "Afghanistan", "Afghanistan", "Afghanistan", "Afghanista~
## $ CAPITAL       <chr> "Kabul", "Kabul", "Kabul", "Kabul", "Kabul", "Kabul", "K~
## $ CONTINENT     <chr> "Asia", "Asia", "Asia", "Asia", "Asia", "Asia", "Asia", ~
## $ AREA          <dbl> 652230, 652230, 652230, 652230, 652230, 652230, 652230, ~
## $ DENSITY       <dbl> 63.0587, 63.0587, 63.0587, 63.0587, 63.0587, 63.0587, 63~
## $ GROWTH_RATE   <dbl> 1.0257, 1.0257, 1.0257, 1.0257, 1.0257, 1.0257, 1.0257, ~
## $ WORLD_POP_PCT <dbl> 0.52, 0.52, 0.52, 0.52, 0.52, 0.52, 0.52, 0.52, 0.04, 0.~
## $ YEAR          <chr> "2022", "2020", "2015", "2010", "2000", "1990", "1980", ~
## $ POPULATION    <dbl> 41128771, 38972230, 33753499, 28189672, 19542982, 106947~
```

```
write.csv(world_long,file='/Users/dirkhartog/Desktop/CUNY_MSDS/DATA_607/PROJECT2/world_pop/worldpop_tid
```

DATA ANALYSIS AND VISUALIZATIONS

```
world_long %>% filter(YEAR %in% c("2020","2022")) %>%
  group_by(CONTINENT, YEAR) %>%
  summarize(sum = sum(POPULATION, na.rm = TRUE),
         max = max(POPULATION, na.rm = TRUE),
         min = min(POPULATION, na.rm = TRUE))
```

```
## `summarise()` has grouped output by 'CONTINENT'. You can override using the
## `.groups` argument.
```

```
## # A tibble: 12 x 5
## # Groups:   CONTINENT [6]
##    CONTINENT     YEAR         sum        max    min
##    <chr>         <chr>      <dbl>      <dbl>  <dbl>
##  1 Africa        2020  1360671810  208327405 105530
##  2 Africa        2022  1426730932  218541212 107118
##  3 Asia          2020  4663086535 1424929781 441725
##  4 Asia          2022  4721383274 1425887337 449002
##  5 Europe        2020   745792196  145617329    520
##  6 Europe        2022   743147538  144713314    510
##  7 North America 2020   594236593  335942003   4500
##  8 North America 2022   600296136  338289857   4390
##  9 Oceania       2020    43933426   25670051   1827
## 10 Oceania       2022    45038554   26177413   1871
## 11 South America 2020   431530043  213196304   3747
## 12 South America 2022   436816608  215313498   3780
```

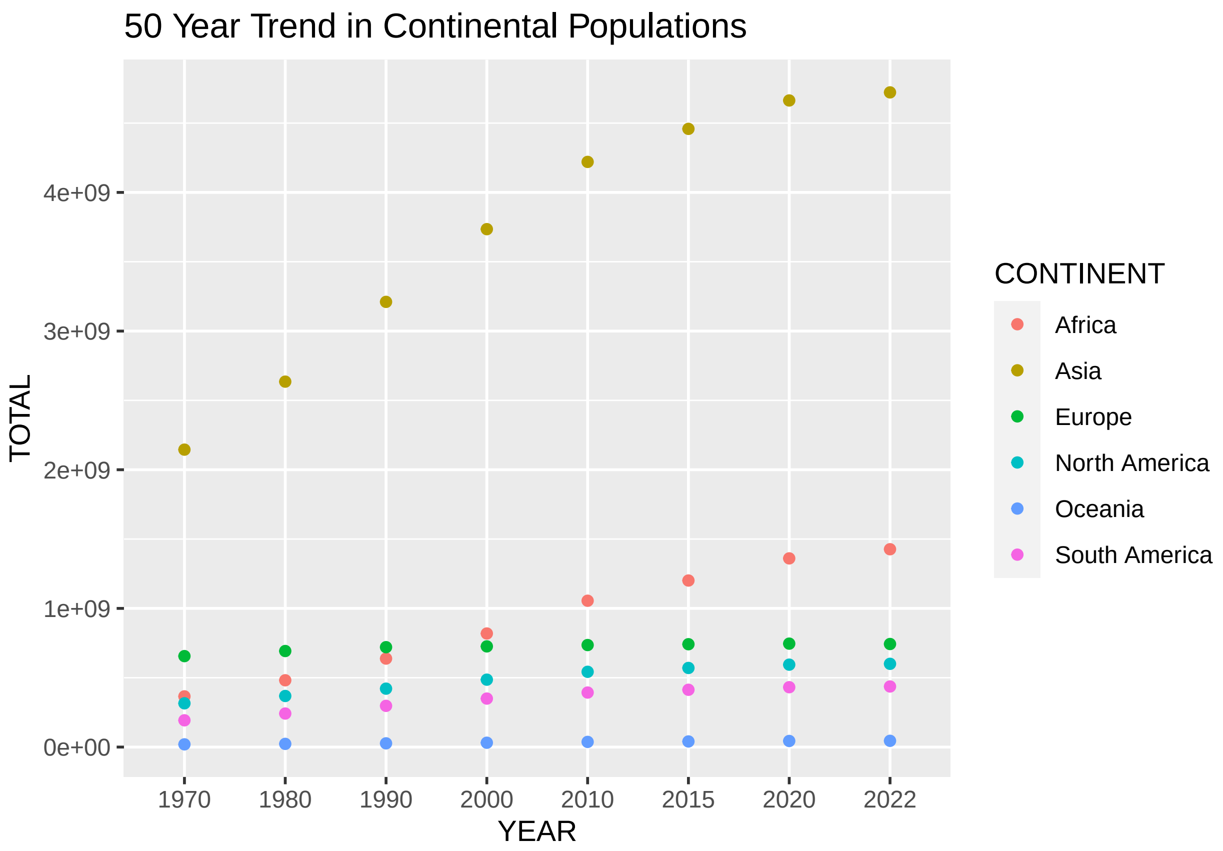
1. Looking at the total populations from each continent by year

```
world_long %>% group_by(CONTINENT, YEAR) %>%
  summarise(TOTAL = sum(POPULATION, na.rm = TRUE))
```

```
## `summarise()` has grouped output by 'CONTINENT'. You can override using the
## `.groups` argument.
## # A tibble: 48 x 3
## # Groups:   CONTINENT [6]
##    CONTINENT YEAR       TOTAL
##    <chr>     <chr>      <dbl>
##  1 Africa    1970   365444348
##  2 Africa    1980   481536377
##  3 Africa    1990   638150629
##  4 Africa    2000   818946032
##  5 Africa    2010  1055228072
##  6 Africa    2015  1201102442
##  7 Africa    2020  1360671810
##  8 Africa    2022  1426730932
##  9 Asia      1970  2144906290
## 10 Asia      1980  2635334228
## # i 38 more rows
```

```
world_long %>% group_by(CONTINENT, YEAR) %>%
  summarise(TOTAL = sum(POPULATION, na.rm = TRUE)) %>%
  ggplot(aes(x = YEAR, y = TOTAL, color = CONTINENT)) +
  geom_point() +
  ggtitle("50 Year Trend in Continental Populations")
```

```
## ‘summarise()‘ has grouped output by ’CONTINENT’. You can override using the
## ‘.groups‘ argument.
```



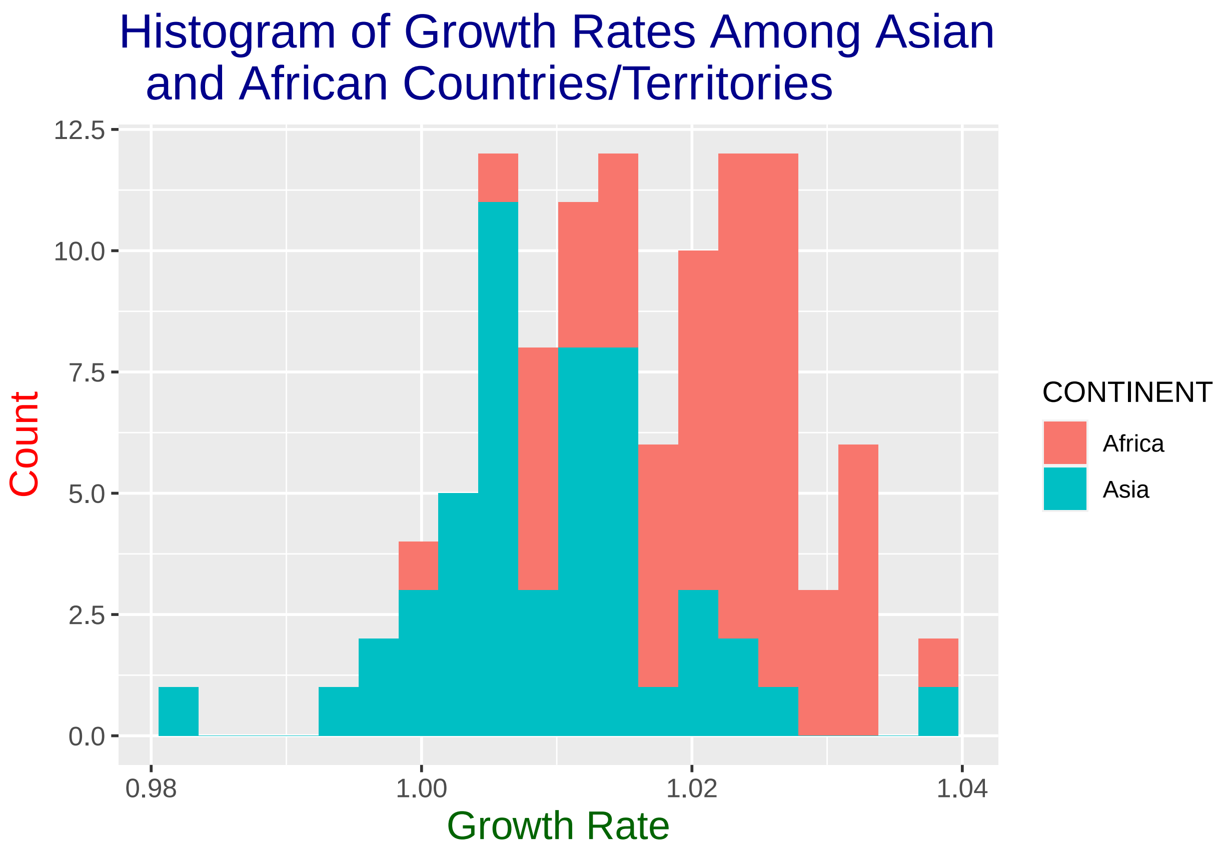
2. Looking at some statistics and trends in growth rates from Asian and African countries in 2022

```r
world_long %>%  filter(YEAR == "2022") %>%
  group_by(CONTINENT) %>%
  summarise(Average_gr = mean(GROWTH_RATE, na.rm = TRUE))
```

```
## # A tibble: 6 x 2
##   CONTINENT     Average_gr
##   <chr>              <dbl>
## 1 Africa              1.02
## 2 Asia                1.01
## 3 Europe              1.00
## 4 North America       1.00
## 5 Oceania             1.01
## 6 South America       1.01
```

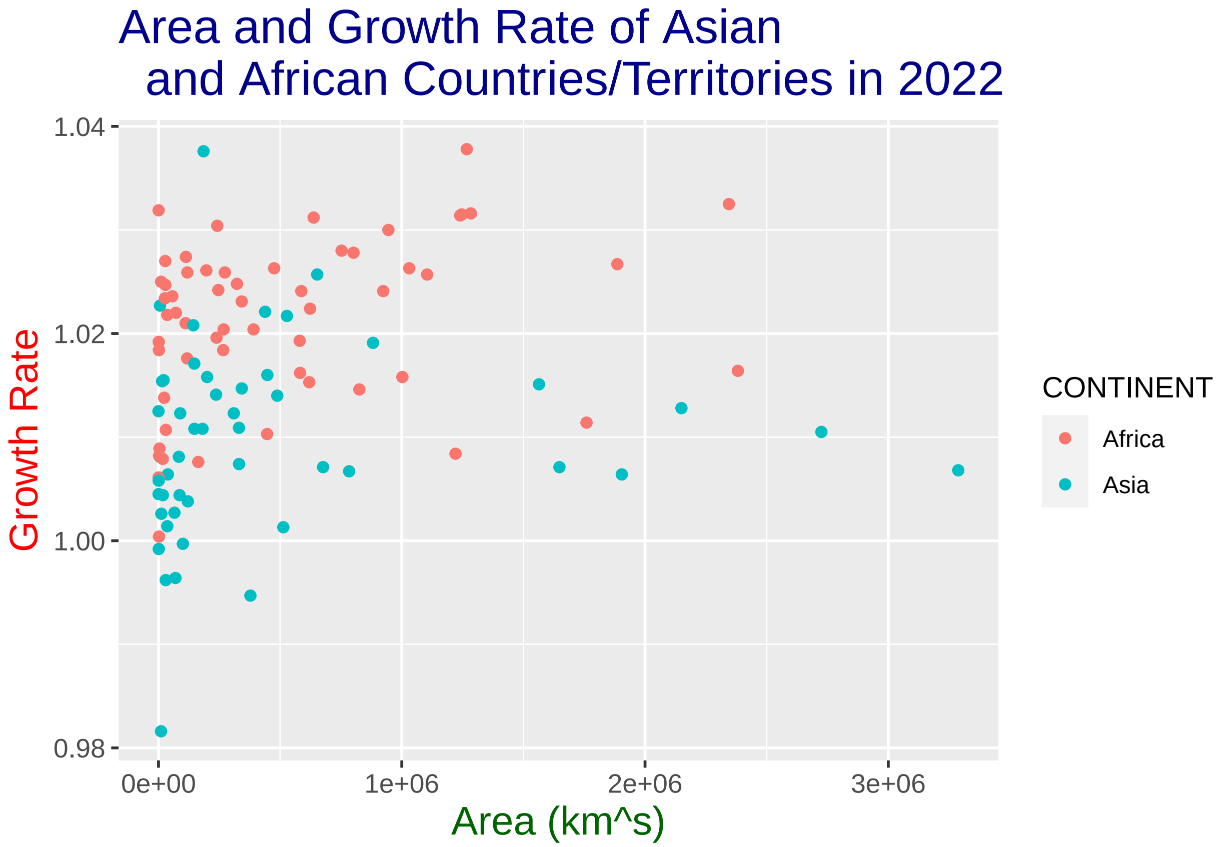
```r
asia_africa <- world_long %>%
  filter(YEAR == "2022" & CONTINENT %in% c("Asia", "Africa"))

ggplot(data = asia_africa, aes(x = GROWTH_RATE)) +
  geom_histogram(bins = 20, aes(fill = CONTINENT)) +
  ggtitle("Histogram of Growth Rates Among Asian
  and African Countries/Territories") +
  ylab("Count") +
  xlab("Growth Rate") +
  theme(axis.title.x = element_text(color="darkgreen",size=15),
        axis.title.y = element_text(color="red", size=15),
        axis.text.x = element_text(size=10),
        axis.text.y = element_text(size=10),
        plot.title = element_text(color="darkblue",
                                  size=18))
```



3. Looking at any relationships in area size less than 5 million (km^2) and growth rate

```
asia_africa %>% filter(AREA < 5000000) %>%
  ggplot(aes(x = AREA, y = GROWTH_RATE, color = CONTINENT)) +
  geom_point() +
  ggtitle("Area and Growth Rate of Asian
  and African Countries/Territories in 2022") +
  ylab("Growth Rate") +
  xlab("Area (km^s)") +
  theme(axis.title.x = element_text(color="darkgreen",size=15),
        axis.title.y = element_text(color="red", size=15),
        axis.text.x = element_text(size=10),
        axis.text.y = element_text(size=10),
        plot.title = element_text(color="darkblue",
                                  size=18))
```



# CONCLUSIONS It is clear that Asian and African countries have seen a larger trend in the growth of their populations over the past 50 years. Despite this it does seem that currently average growth rates across the globe are pretty similar between 1.002 - 1.02. This growth rate might seem small but when talking about populations, a 1% grwoth rate is still a lot of people!