Plot

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Introduction

A data set of the 2016 US election polls was given. In this project we aim to understand the data structure by creating various visualizations.

Method

We use various R packages to present the data set and to plot the graphs.

```
knitr::opts_chunk$set(echo = FALSE)
library(plotly)
```

```
## Loading required package: ggplot2
```

```
##
## Attaching package: 'plotly'
```

```
## The following object is masked from 'package:ggplot2':
##
##     last_plot
```

```
## The following object is masked from 'package:stats':
##
##     filter
```

```
## The following object is masked from 'package:graphics':
##
##     layout
```

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v forcats   1.0.0     v stringr   1.5.0
## v lubridate 1.9.2     v tibble    3.2.1
## v purrr     1.0.2     v tidyr     1.3.0
## v readr     2.1.4

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks plotly::filter(), 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
```

```
library(ggplot2)
library(patchwork)
library(tidyr)
```

Result

We first take a look at the raw data set:

As we can see, there are a few variables with missing values:

```
##     state            startdate           enddate            pollster
##  Length:4208        Length:4208        Length:4208        Length:4208
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##     grade              samplesize       population        rawpoll_clinton
##  Length:4208        Min.   :   35.0   Length:4208        Min.   :11.04
##  Class :character   1st Qu.:  447.5   Class :character   1st Qu.:38.00
##  Mode  :character   Median :  772.0   Mode  :character   Median :43.00
##                     Mean   : 1148.2                      Mean   :41.99
##                     3rd Qu.: 1236.5                      3rd Qu.:46.20
##                     Max.   :84292.0                      Max.   :88.00
##                     NA's   :1
##  rawpoll_trump   rawpoll_johnson  rawpoll_mcmullin adjpoll_clinton
##  Min.   : 4.00   Min.   : 0.000   Min.   : 9.0     Min.   :17.06
##  1st Qu.:35.00   1st Qu.: 5.400   1st Qu.:22.5     1st Qu.:40.21
##  Median :40.00   Median : 7.000   Median :25.0     Median :44.15
##  Mean   :39.83   Mean   : 7.382   Mean   :24.0     Mean   :43.32
##  3rd Qu.:45.00   3rd Qu.: 9.000   3rd Qu.:27.9     3rd Qu.:46.92
##  Max.   :68.00   Max.   :25.000   Max.   :31.0     Max.   :86.77
##                  NA's   :1409     NA's   :4178
```

```
##  adjpoll_trump    adjpoll_johnson  adjpoll_mcmullin
##  Min.   : 4.373   Min.   :-3.668   Min.   :11.03
##  1st Qu.:38.429   1st Qu.: 3.145   1st Qu.:23.11
##  Median :42.765   Median : 4.384   Median :25.14
##  Mean   :42.674   Mean   : 4.660   Mean   :24.51
##  3rd Qu.:46.290   3rd Qu.: 5.756   3rd Qu.:27.98
##  Max.   :72.433   Max.   :20.367   Max.   :31.57
##                   NA's   :1409     NA's   :4178
```

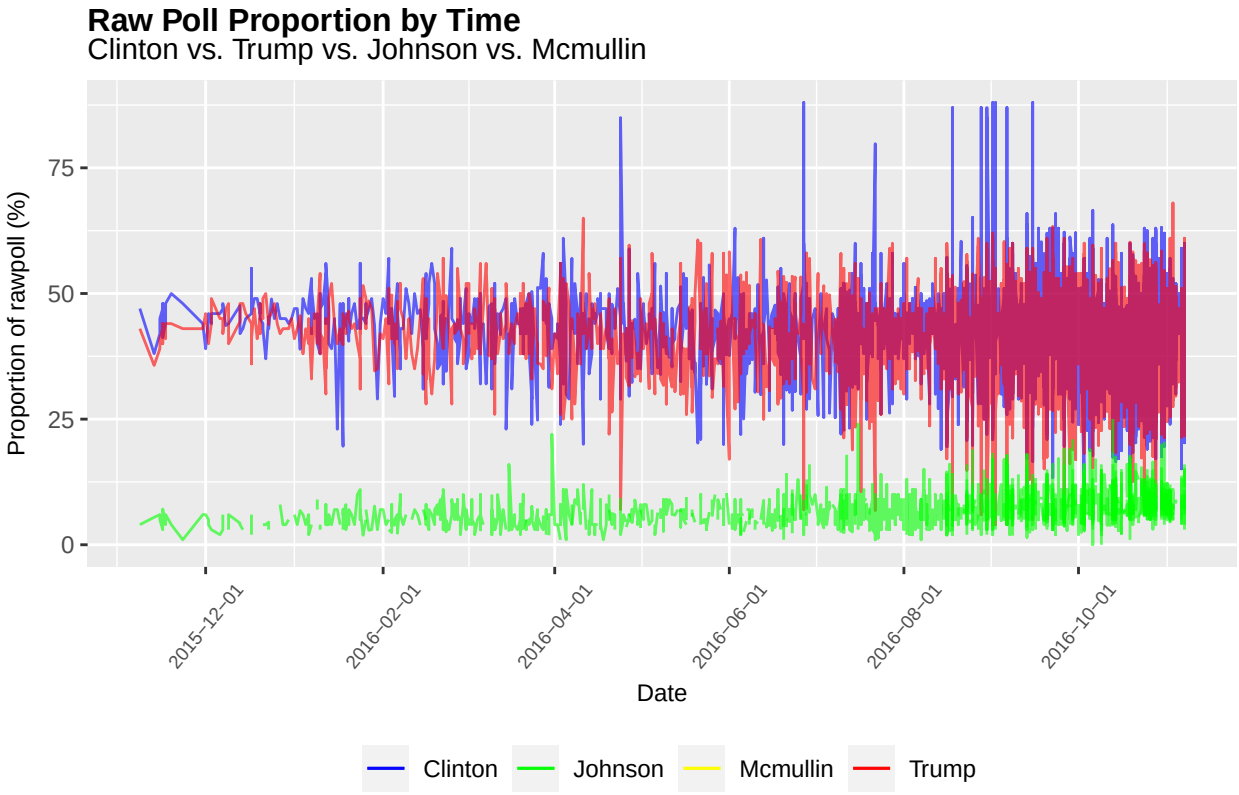
```
##   start_time   end_time clinton trump johnson mcmullin
## 1 2016-11-03 2016-11-06   47.00 43.00    4.00       NA
## 2 2016-11-01 2016-11-07   38.03 35.69    5.46       NA
## 3 2016-11-02 2016-11-06   42.00 39.00    6.00       NA
## 4 2016-11-04 2016-11-07   45.00 41.00    5.00       NA
## 5 2016-11-03 2016-11-06   47.00 43.00    3.00       NA
## 6 2016-11-03 2016-11-06   48.00 44.00    3.00       NA
```

```
##      start_time   end_time clinton trump johnson mcmullin
## 3872 2015-11-07 2015-11-08      42    47      NA       NA
## 3968 2015-11-09 2015-11-13      50    36      NA       NA
## 4104 2015-11-11 2015-11-15      37    48      NA       NA
## 4138 2015-11-12 2015-11-15      48    38      NA       NA
## 3847 2015-11-10 2015-11-16      41    40      NA       NA
## 3857 2015-11-10 2015-11-16      41    44      NA       NA
```

Without removing the missing values:

```
## Warning: Removed 2 rows containing missing values (‘geom_line()‘).
```

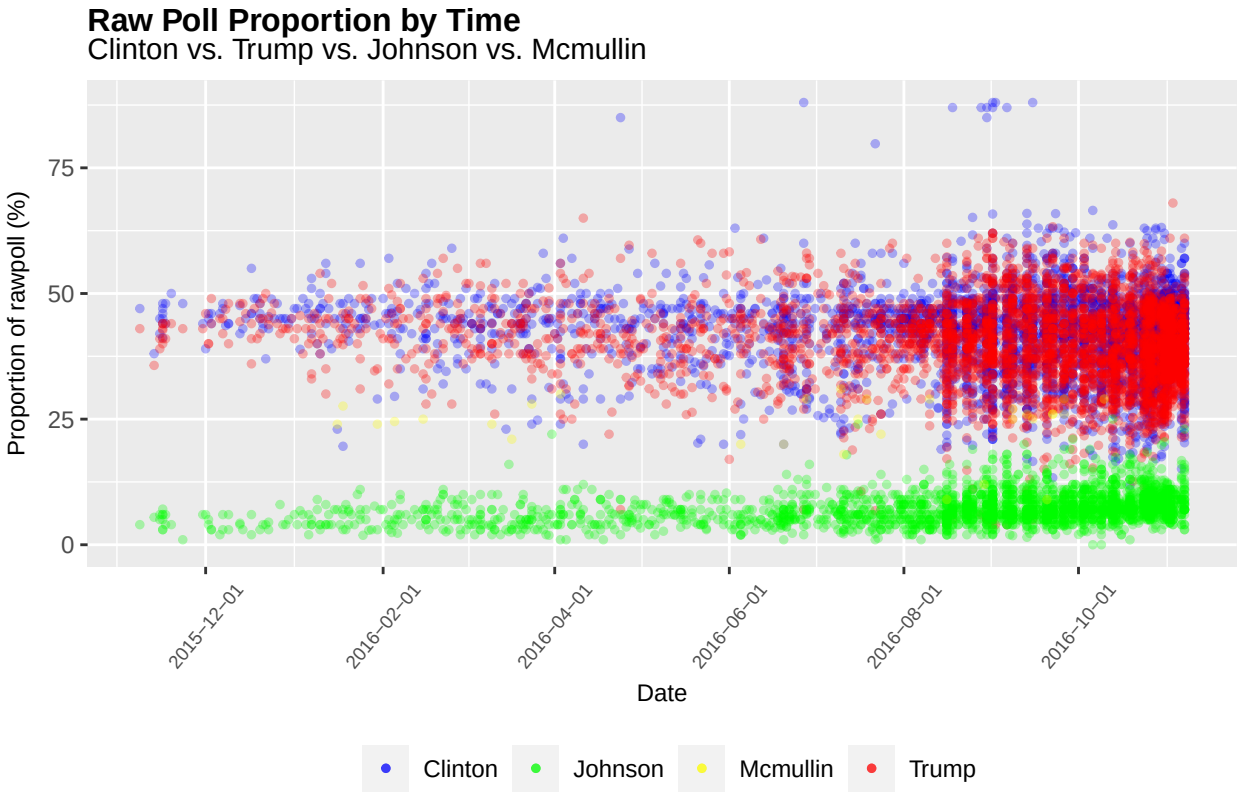
```
## Warning: Removed 1895 rows containing missing values (‘geom_line()‘).
```



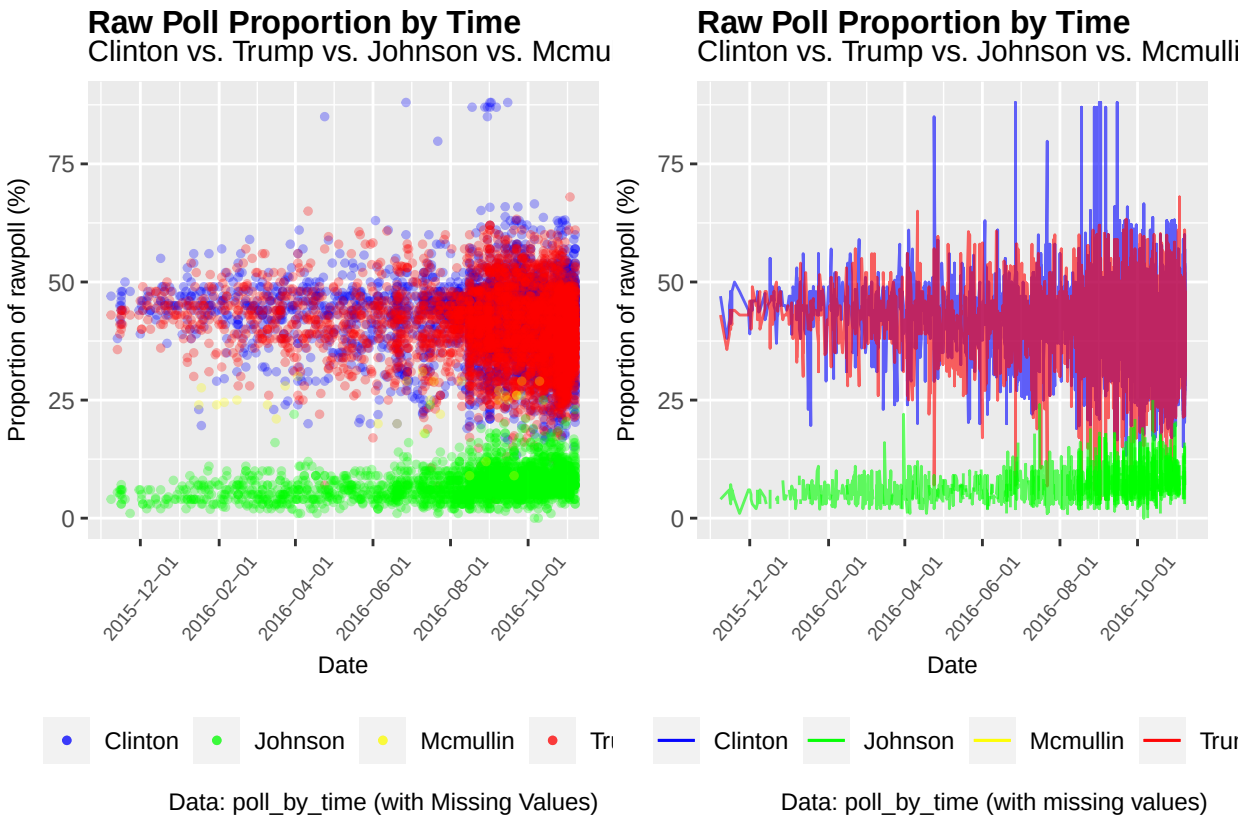
Scatter plot with uncleaned date:

```
## Warning: Removed 1409 rows containing missing values (‘geom_point()‘).
```

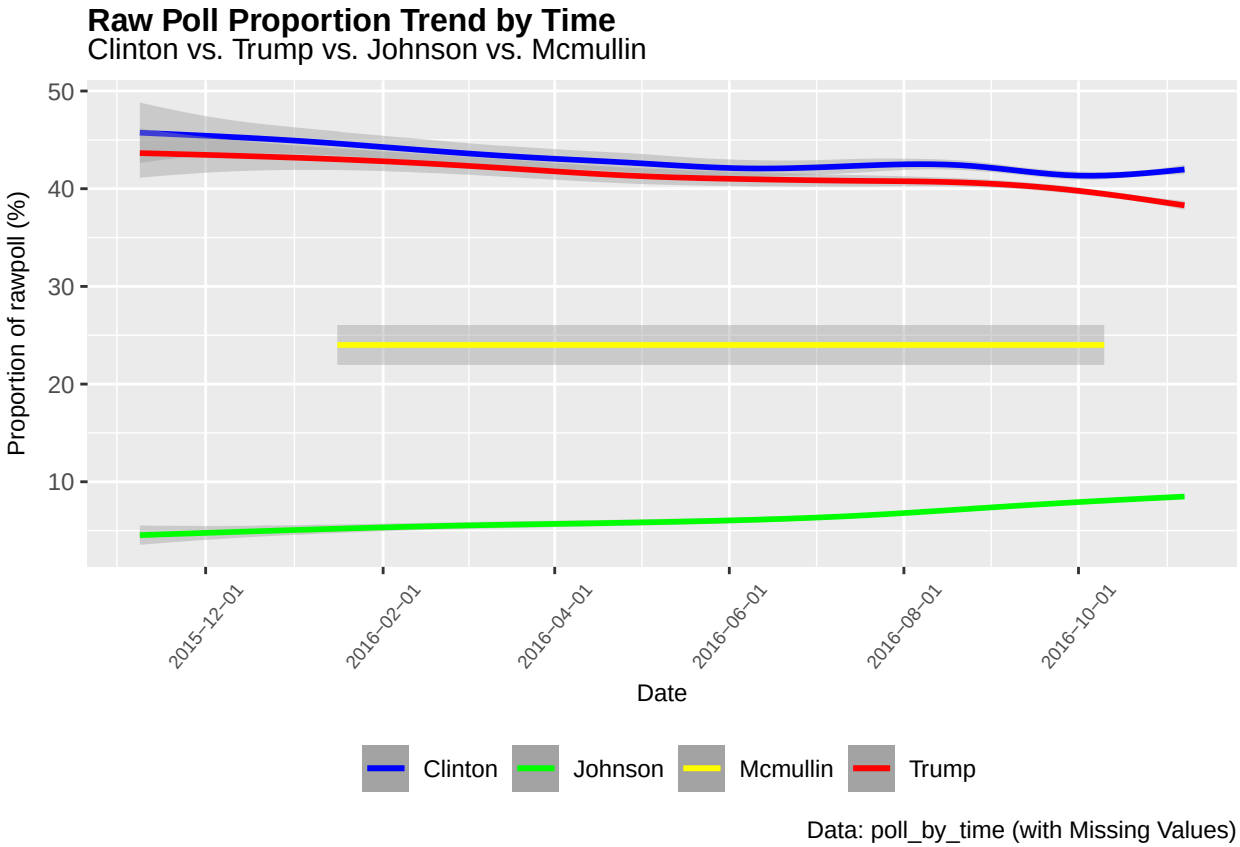
```
## Warning: Removed 4178 rows containing missing values (‘geom_point()‘).
```




```
## Warning: Removed 1409 rows containing missing values (`geom_point()`).

## Warning: Removed 4178 rows containing missing values (`geom_point()`).

## Warning: Removed 2 rows containing missing values (`geom_line()`).

## Warning: Removed 1895 rows containing missing values (`geom_line()`).
```



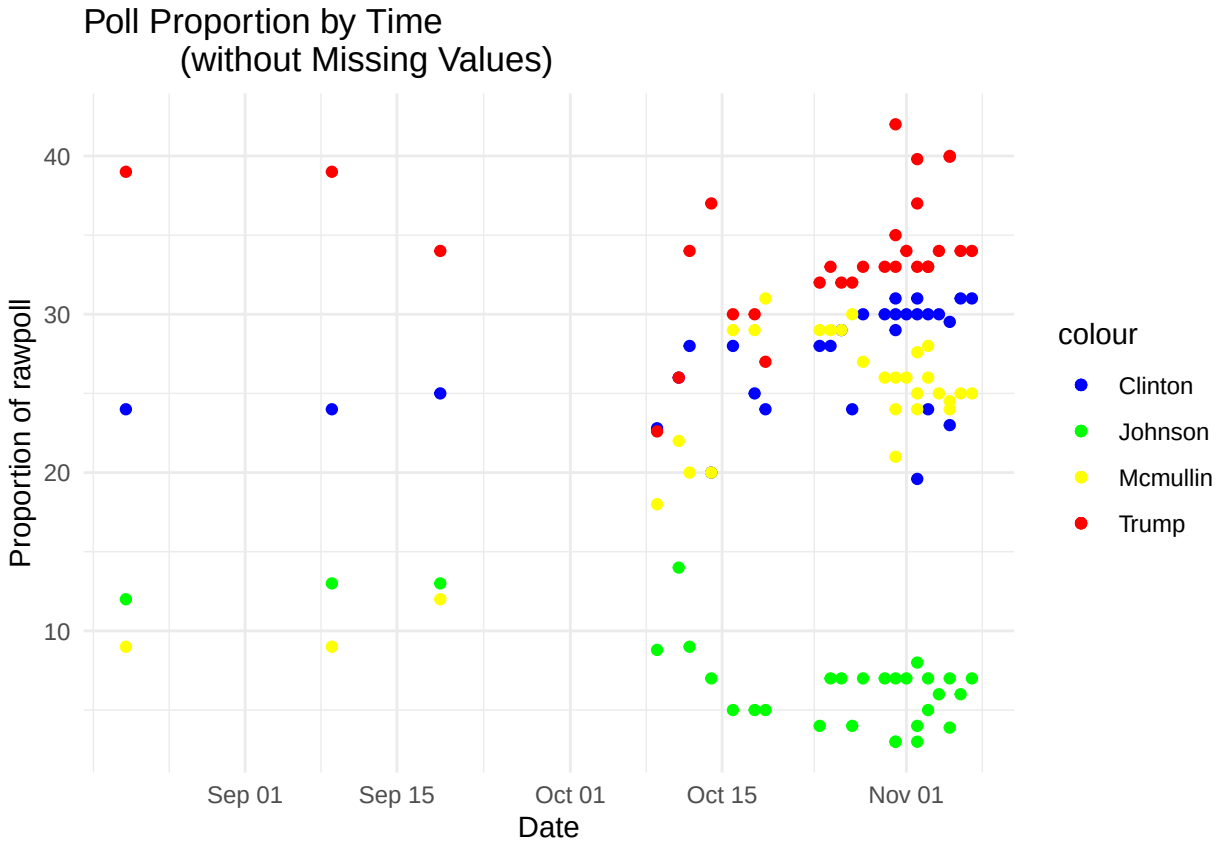

```
## `geom_smooth()` using method = 'gam' and formula = 'y ~ s(x, bs = "cs")'
## `geom_smooth()` using method = 'gam' and formula = 'y ~ s(x, bs = "cs")'
## `geom_smooth()` using method = 'gam' and formula = 'y ~ s(x, bs = "cs")'

## Warning: Removed 1409 rows containing non-finite values (`stat_smooth()`).

## `geom_smooth()` using method = 'gam' and formula = 'y ~ s(x, bs = "cs")'

## Warning: Removed 4178 rows containing non-finite values (`stat_smooth()`).
```



Remove the missing values, count the row number of 4 candidates cleaned data:

```
## [1] 30
```

Using the data with missing values deleted, a trend chart showing the change in the proportion of votes obtained by all four candidates over time is made.



3 candidate's (Clinton, Trump and Johnson) trend by time with cleaned data.

```
##   start_time   end_time clinton trump johnson
## 1 2016-11-03 2016-11-06   47.00 43.00    4.00
## 2 2016-11-01 2016-11-07   38.03 35.69    5.46
## 3 2016-11-02 2016-11-06   42.00 39.00    6.00
## 4 2016-11-04 2016-11-07   45.00 41.00    5.00
## 5 2016-11-03 2016-11-06   47.00 43.00    3.00
## 6 2016-11-03 2016-11-06   48.00 44.00    3.00
```

3 candidates data removing the missing values:

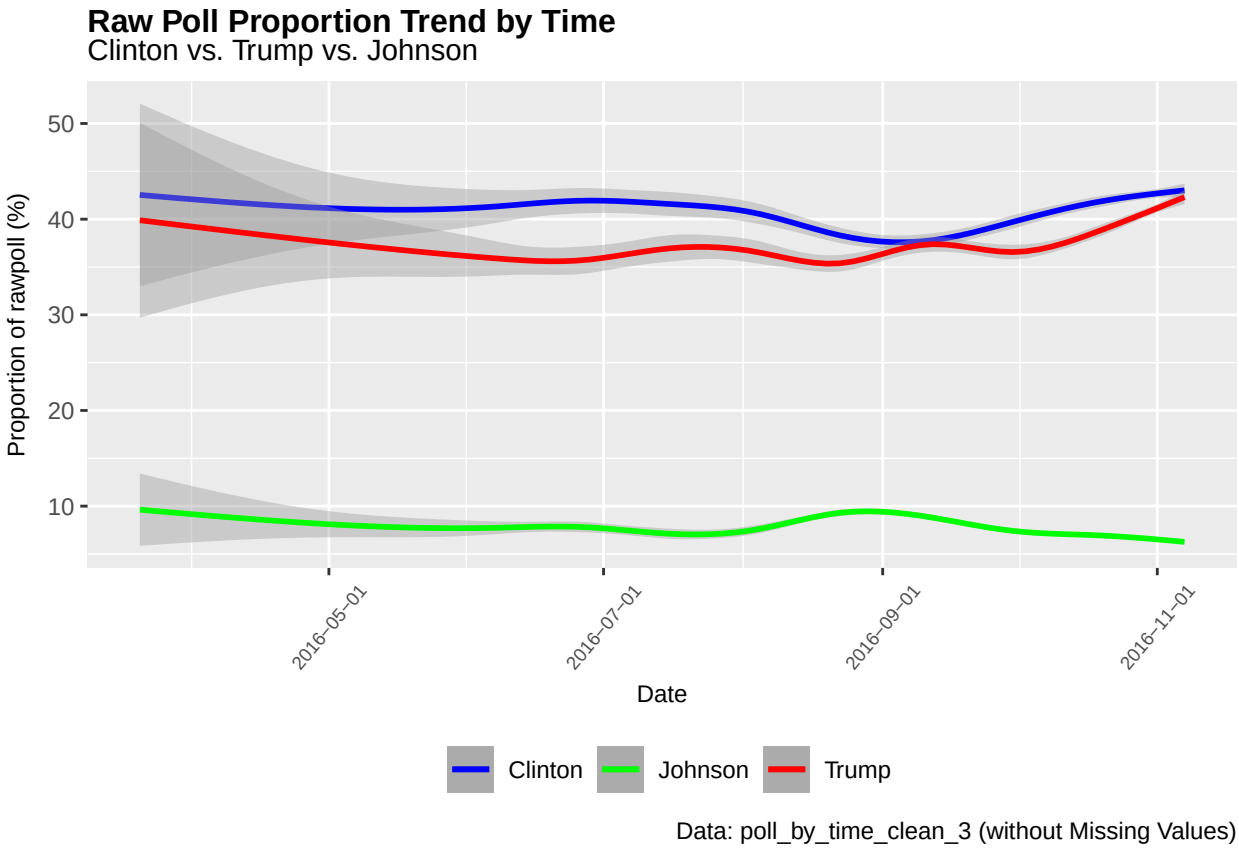
```
##   start_time   end_time clinton trump johnson
## 1 2016-11-03 2016-11-06   47.00 43.00    4.00
## 2 2016-11-01 2016-11-07   38.03 35.69    5.46
## 3 2016-11-02 2016-11-06   42.00 39.00    6.00
## 4 2016-11-04 2016-11-07   45.00 41.00    5.00
## 5 2016-11-03 2016-11-06   47.00 43.00    3.00
## 6 2016-11-03 2016-11-06   48.00 44.00    3.00
```

```
##      start_time   end_time clinton trump johnson
## 3496 2016-03-17 2016-03-20      42    34      11
## 3536 2016-03-28 2016-03-30      49    41      10
## 3562 2016-04-23 2016-04-25      49    40       8
## 2906 2016-05-02 2016-05-04      28    48       6
## 3390 2016-05-06 2016-05-09      42    38       4
## 2999 2016-05-13 2016-05-15      41    33      14
```

```
## [1] 2799
```

Using the data with missing values deleted, a trend chart showing the change in the proportion of votes obtained by 3 candidates (Clinton, Trump and Johnson) over time is made.

```
## `geom_smooth()` using method = 'gam' and formula = 'y ~ s(x, bs = "cs")'
## `geom_smooth()` using method = 'gam' and formula = 'y ~ s(x, bs = "cs")'
## `geom_smooth()` using method = 'gam' and formula = 'y ~ s(x, bs = "cs")'
```



2 candidate's (Clinton, Trump) trend by time with cleaned data.

```
##   start_time   end_time clinton trump
## 1 2016-11-03 2016-11-06   47.00 43.00
## 2 2016-11-01 2016-11-07   38.03 35.69
## 3 2016-11-02 2016-11-06   42.00 39.00
## 4 2016-11-04 2016-11-07   45.00 41.00
## 5 2016-11-03 2016-11-06   47.00 43.00
## 6 2016-11-03 2016-11-06   48.00 44.00
```

2 candidates data removing the missing values:

```
##   start_time   end_time clinton trump
## 1 2016-11-03 2016-11-06   47.00 43.00
## 2 2016-11-01 2016-11-07   38.03 35.69
## 3 2016-11-02 2016-11-06   42.00 39.00
```

```
## 4 2016-11-04 2016-11-07   45.00 41.00
## 5 2016-11-03 2016-11-06   47.00 43.00
## 6 2016-11-03 2016-11-06   48.00 44.00
```

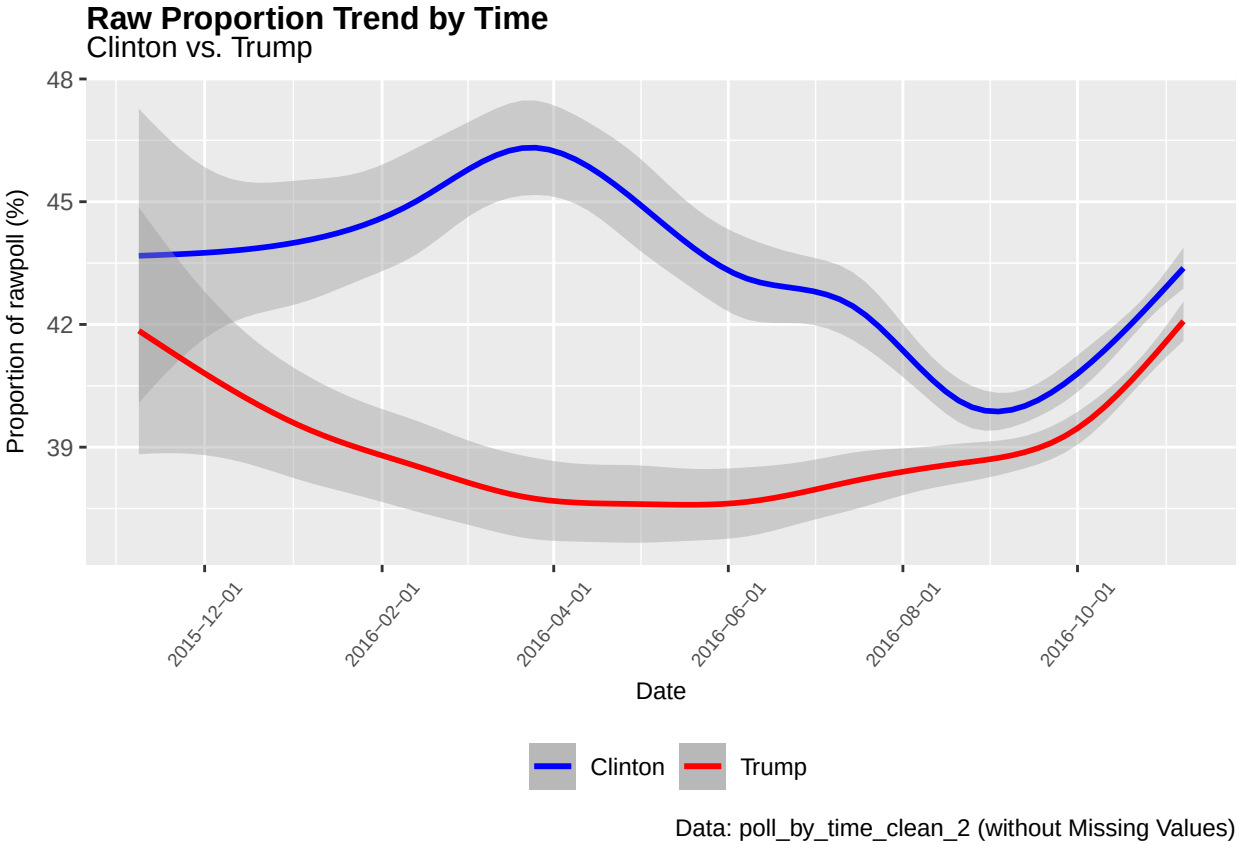
```
##      start_time   end_time clinton trump
## 3872 2015-11-07 2015-11-08      42    47
## 3968 2015-11-09 2015-11-13      50    36
## 4104 2015-11-11 2015-11-15      37    48
## 4138 2015-11-12 2015-11-15      48    38
## 3847 2015-11-10 2015-11-16      41    40
## 3857 2015-11-10 2015-11-16      41    44
```

```
##      start_time   end_time clinton trump
## 649  2016-11-01 2016-11-07   23.23 47.41
## 651  2016-11-01 2016-11-07   52.12 18.86
## 677  2016-11-01 2016-11-07   53.62 10.62
## 691  2016-11-01 2016-11-07   40.69 23.10
## 709  2016-11-01 2016-11-07   43.62 28.72
## 4206 2016-11-01 2016-11-07   21.33 35.05
```

```
## [1] 4208
```

Using the data with missing values deleted, a trend chart showing the change in the proportion of votes obtained by 2 candidates (Clinton vs. Trump) over time is made.

```
## `geom_smooth()` using method = 'gam' and formula = 'y ~ s(x, bs = "cs")'
## `geom_smooth()` using method = 'gam' and formula = 'y ~ s(x, bs = "cs")'
```



Explore population types tend to vote for Clinton with population variable:

```
##   start_time   end_time clinton trump johnson mcmullin population
## 1 2016-11-03 2016-11-06   47.00 43.00    4.00       NA         lv
## 2 2016-11-01 2016-11-07   38.03 35.69    5.46       NA         lv
## 3 2016-11-02 2016-11-06   42.00 39.00    6.00       NA         lv
## 4 2016-11-04 2016-11-07   45.00 41.00    5.00       NA         lv
## 5 2016-11-03 2016-11-06   47.00 43.00    3.00       NA         rv
## 6 2016-11-03 2016-11-06   48.00 44.00    3.00       NA         lv
```

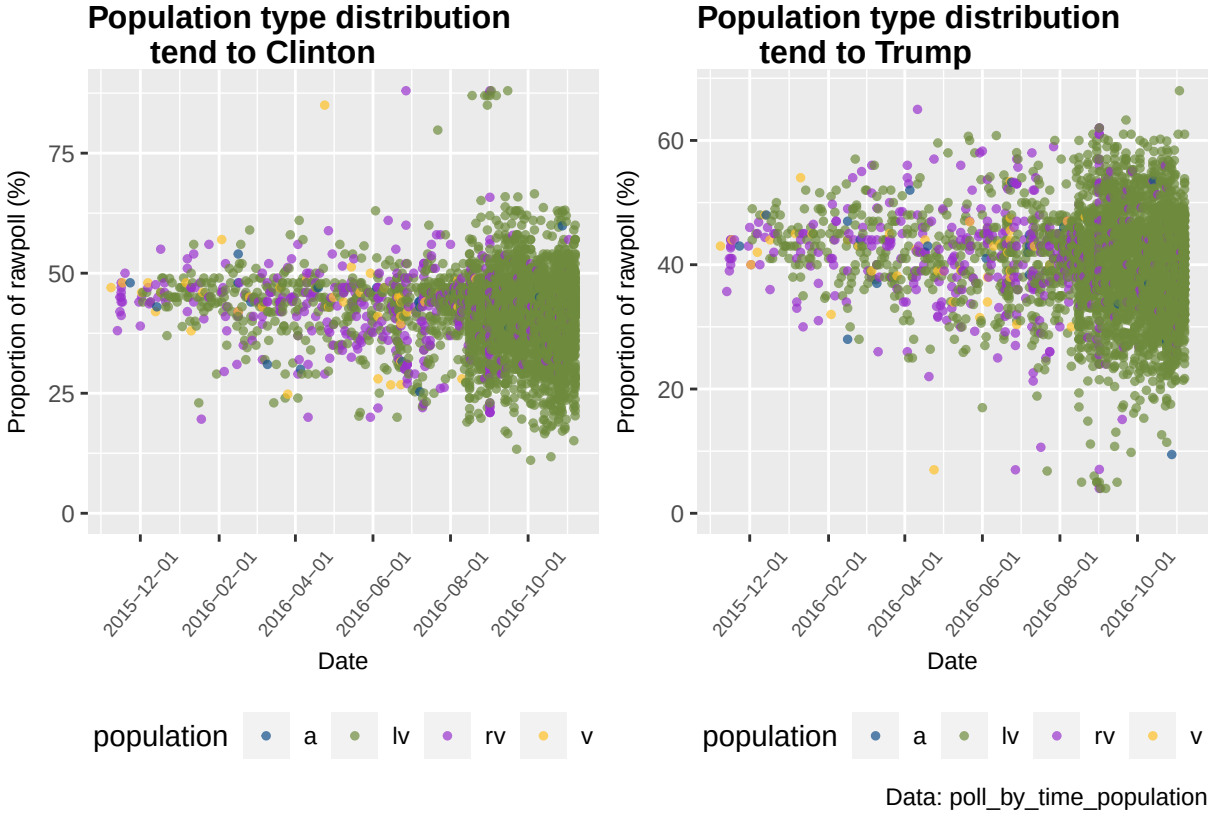
```
##      start_time   end_time clinton trump johnson mcmullin population
## 3872 2015-11-07 2015-11-08      42    47      NA       NA          v
## 3968 2015-11-09 2015-11-13      50    36      NA       NA         rv
## 4104 2015-11-11 2015-11-15      37    48      NA       NA         rv
## 4138 2015-11-12 2015-11-15      48    38      NA       NA         rv
## 3847 2015-11-10 2015-11-16      41    40      NA       NA         rv
## 3857 2015-11-10 2015-11-16      41    44      NA       NA         rv
```

Scatter plot for population distribution tend to Clinton:

Scatter plot for population distribution tend to Trump:

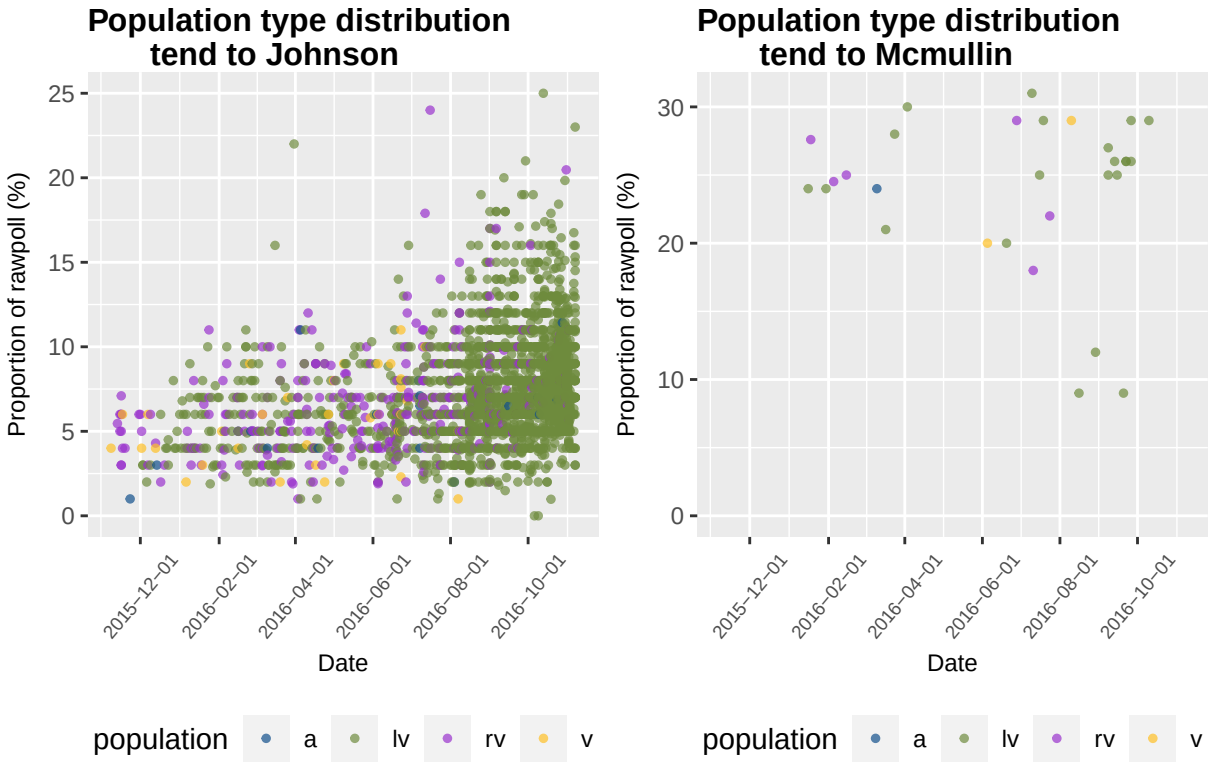
Scatter plot for population distribution tend to Johnson:

Scatter plot for population distribution tend to Mcmullin::




```
## Warning: Removed 1409 rows containing missing values (`geom_point()`).
```

```
## Warning: Removed 4178 rows containing missing values (`geom_point()`).
```



Data: poll_by_time_population

By states:

```
##   state prop_clinton prop_trump prop_johnson prop_mcmullin  size
## 1  U.S.         47.00      43.00         4.00             0  2220
## 2  U.S.         38.03      35.69         5.46             0 26574
## 3  U.S.         42.00      39.00         6.00             0  2195
## 4  U.S.         45.00      41.00         5.00             0  3677
## 5  U.S.         47.00      43.00         3.00             0 16639
## 6  U.S.         48.00      44.00         3.00             0  1295
##   NumVote_clinton NumVote_trump NumVote_johnson NumVote_mcmullin
## 1         1043.40       954.600           88.80                0
## 2        10106.09      9484.261         1450.94                0
## 3          921.90       856.050          131.70                0
## 4         1654.65      1507.570          183.85                0
## 5         7820.33      7154.770          499.17                0
## 6          621.60       569.800           38.85                0
```

Clinton total raw polls by state:

```
## # A tibble: 6 x 2
##   state      ClintonPolls
##   <chr>             <dbl>
## 1 Alabama           8711.
## 2 Alaska            4150.
## 3 Arizona          28816.
## 4 Arkansas          6240.
## 5 California       54446.
## 6 Colorado         30808.
```

Trump total raw polls by state:

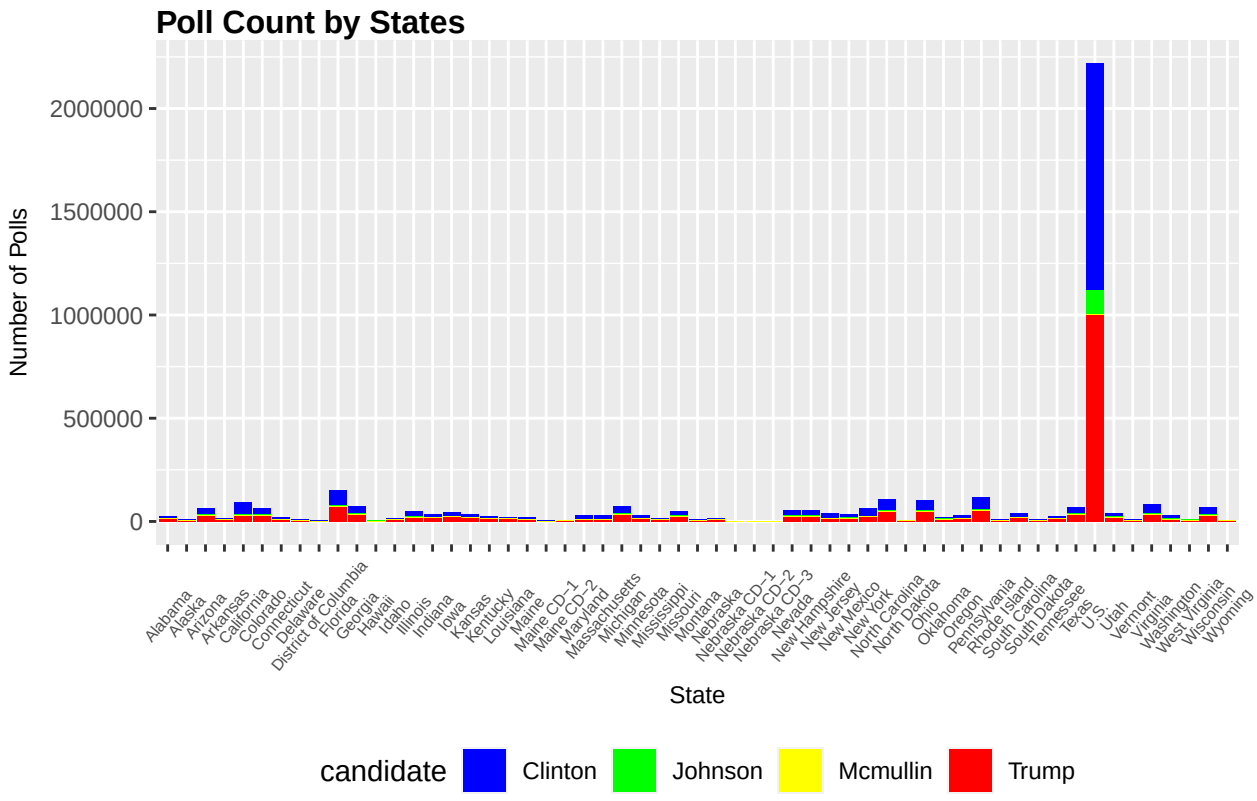
```
## # A tibble: 6 x 2
##   state      TrumpPolls
##   <chr>           <dbl>
## 1 Alabama        15130.
## 2 Alaska          5092.
## 3 Arizona        29132.
## 4 Arkansas        9085.
## 5 California     30586.
## 6 Colorado       27525.
```

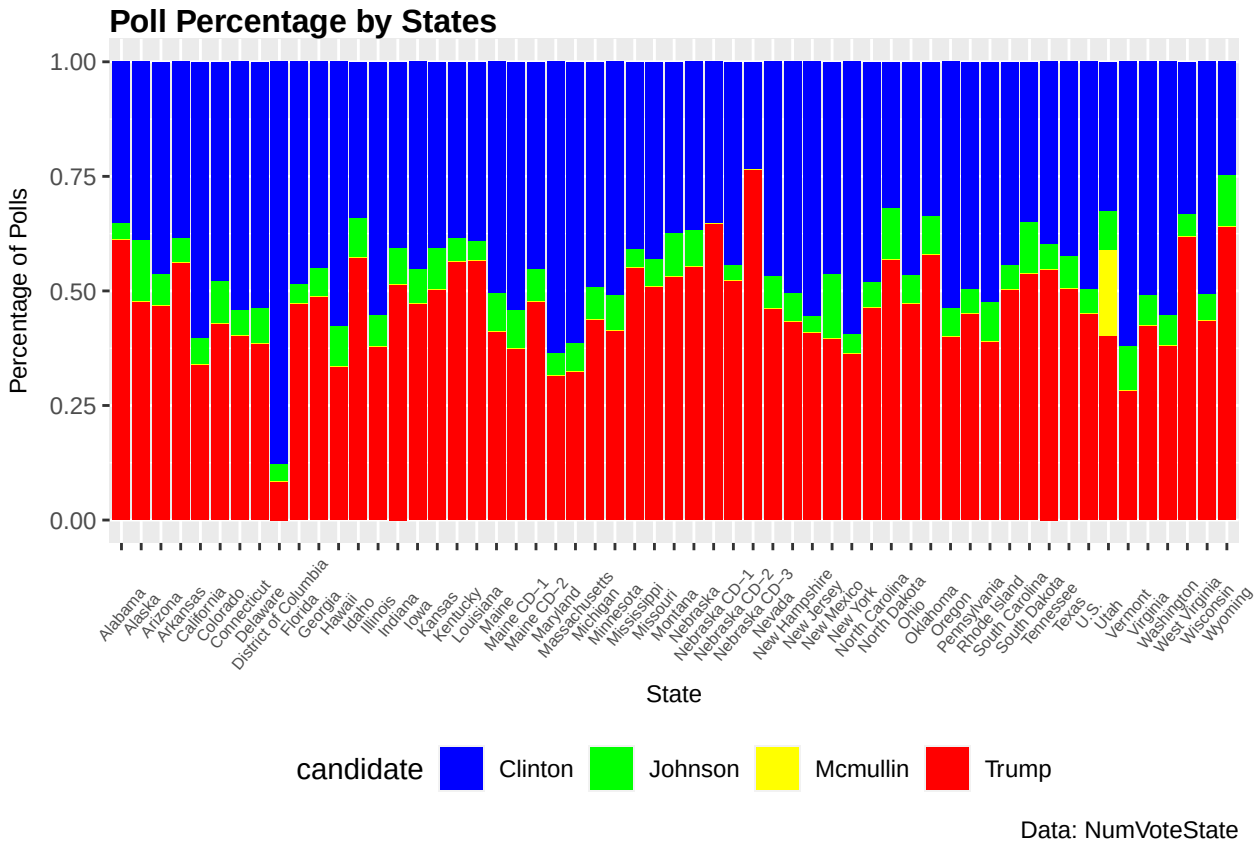
Johnson total raw polls by state:

```
## # A tibble: 6 x 2
##   state      JohnsonPolls
##   <chr>             <dbl>
## 1 Alabama            840.
## 2 Alaska            1424.
## 3 Arizona           4252.
## 4 Arkansas           870.
## 5 California        5260.
## 6 Colorado          5928.
```

Mcmullin total raw polls by state:

```
## # A tibble: 6 x 2
##   state      McmullinPolls
##   <chr>              <dbl>
## 1 Alabama                0
## 2 Alaska                 0
## 3 Arizona                0
## 4 Arkansas               0
## 5 California             0
## 6 Colorado               0
```


Poll Count by States
Number of Polls
2000000
1500000
1000000
500000
0
Alabama
Alaska
Arizona
Arkansas
California
Colorado
Connecticut
Delaware
District of Columbia
Florida
Georgia
Hawaii
Idaho
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Maine
Maine CD−1
Maine CD−2
Maryland
Massachusetts
Michigan
Minnesota
Mississippi
Missouri
Montana
Nebraska
Nebraska CD−1
Nebraska CD−2
Nebraska CD−3
Nevada
New Hampshire
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
Rhode Island
South Carolina
South Dakota
Tennessee
Texas
U.S.
Utah
Vermont
Virginia
Washington
West Virginia
Wisconsin
Wyoming
State
candidate
Clinton
Johnson
Mcmullin
Trump
Data: NumVoteState


Poll Percentage by States
Percentage of Polls
1.00
0.75
0.50
0.25
0.00
Alabama
Alaska
Arizona
Arkansas
California
Colorado
Connecticut
Delaware
District of Columbia
Florida
Georgia
Hawaii
Idaho
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Maine
Maine CD−1
Maine CD−2
Maryland
Massachusetts
Michigan
Minnesota
Mississippi
Missouri
Montana
Nebraska
Nebraska CD−1
Nebraska CD−2
Nebraska CD−3
Nevada
New Hampshire
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
Rhode Island
South Carolina
South Dakota
Tennessee
Texas
U.S.
Utah
Vermont
Virginia
Washington
West Virginia
Wisconsin
Wyoming
State
candidate
Clinton
Johnson
Mcmullin
Trump
Data: NumVoteState