PSC4375: Summarizing bivariate relationships: cross-tabs, scatterplots, and correlation

Week 4: Lecture 8

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Effect of assasination attempts

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```r
library(tidyverse)
data(leaders, package = "qss")
head(leaders[,1:7])
```

```
##   year     country       leadername age politybefore
## 1 1929 Afghanistan Habibullah Ghazi  39           -6
## 2 1933 Afghanistan       Nadir Shah  53           -6
## 3 1934 Afghanistan      Hashim Khan  50           -6
## 4 1924     Albania             Zogu  29            0
## 5 1931     Albania             Zogu  36           -9
## 6 1968     Algeria      Boumedienne  41           -9
##   polityafter interwarbefore
## 1   -6.000000              0
## 2   -7.333333              0
## 3   -8.000000              0
## 4   -9.000000              0
## 5   -9.000000              0
## 6   -9.000000              0
```

Before we begin with lesson, Pset 2 help

```
PolityAfter <- leaders %>%
  group_by(civilwarbefore) %>%
  summarize(polityafter_mean = mean(polityafter))

PolityAfterPlot <- PolityAfter %>%
  ggplot(aes(x=as.factor(civilwarbefore), y = polityafter_mean
  geom_bar(stat = "identity", alpha=0.75) +
  scale_x_discrete(labels = c("No civil war","Civil war")) +
  labs(title = "Dem. score after assasin. attempt",
       y = "Average Democracy Score", x = "") +
  theme_bw()
```

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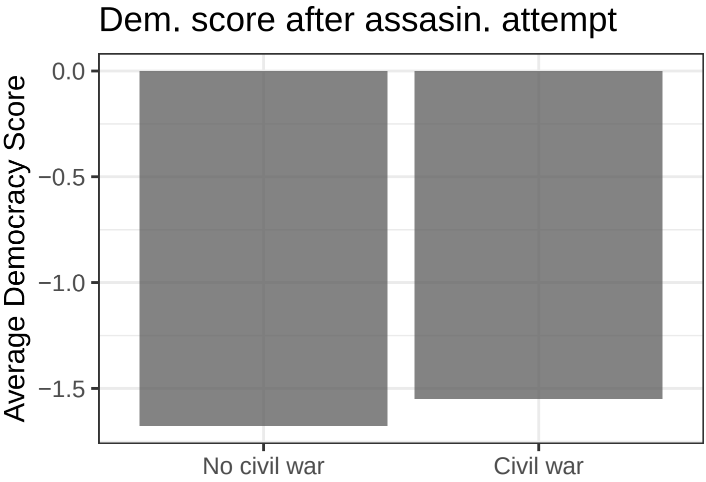
```
PolityAfterPlot
```



More Pset 2 help!

Question 5 update:

- Given that the number of children might be a confounder for the relationship between number of girls and voting, let's estimate the effects using statistical control for the number of children using the following steps:
  - Create one subset of the data called `girls_123` that restricts to judges with one, two or three children and have at least one girl.
  - Create another subset of the data called `nogirls_123` that restricts to judges with one, two or three children and have no girls.
  - Calculate the mean of `progressive_vote` within levels of the numbers of kids (`num_kids`) for each of these subsets and save these vectors as `girls_vote_by_nkids` and `nogirls_vote_by_nkids`.
  - Use `inner_join` to combine the two data subsets then estimate the average treatment effect within levels, saving this vector as `ate_nkids`.

More Pset 2 help!

- Use `inner_join` to combine the two data subsets...

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  group_by(civilwarbefore) %>%
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PolityCombine <- inner_join(PolityAfter,PolityBefore)
PolityCombine
```

```
## # A tibble: 2 x 3
##   civilwarbefore polityafter_mean politybefore_mean
##            <int>            <dbl>             <dbl>
## 1              0            -1.68             -1.52
## 2              1            -1.55             -1.53
```

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```
leaders %>%
  group_by(civilwarbefore,civilwarafter) %>%
  count() %>%
  spread(civilwarafter, n)
```

```
## # A tibble: 2 x 3
## # Groups:   civilwarbefore [2]
##   civilwarbefore   `0`   `1`
##            <int> <int> <int>
## 1              0   177    19
## 2              1    27    27
```

- Quick summary how the two variables "go together"

Cross-tabs with proportions

```
leaders %>%
  group_by(civilwarbefore,civilwarafter) %>%
  count() %>%
  ungroup() %>%
  mutate(prop = n/ sum(n)) %>%
  select(-n) %>%
  spread(civilwarafter, prop, drop = T)
```

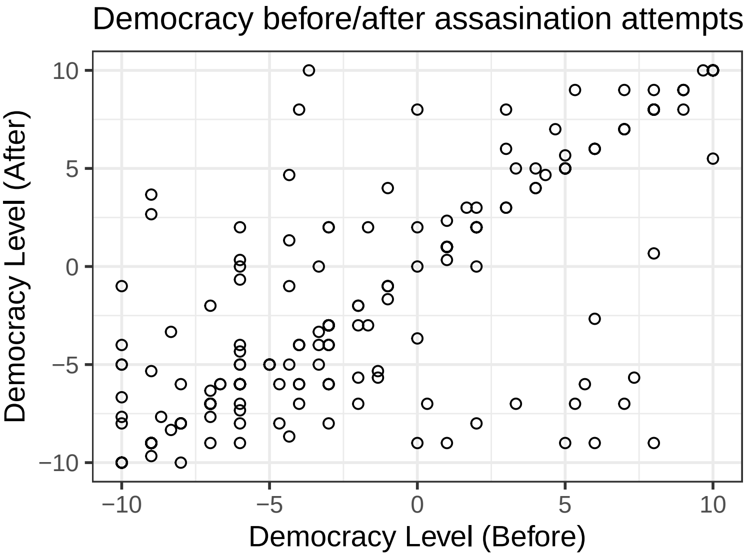
```
## # A tibble: 2 x 3
##   civilwarbefore   `0`   `1`
##            <int> <dbl> <dbl>
## 1              0 0.708 0.076
## 2              1 0.108 0.108
```

Cross-tabs with proportions (by row)

```
leaders %>%
  group_by(civilwarbefore,civilwarafter) %>%
  count() %>%
  ungroup() %>%
  group_by(civilwarbefore) %>%
  mutate(prop = n/ sum(n)) %>%
  select(-n) %>%
  spread(civilwarafter, prop, drop = T)
```

```
## # A tibble: 2 x 3
## # Groups:   civilwarbefore [2]
##   civilwarbefore   `0`    `1`
##            <int> <dbl>  <dbl>
## 1              0 0.903 0.0969
## 2              1 0.5   0.5
```

Scatterplot



Scatterplot

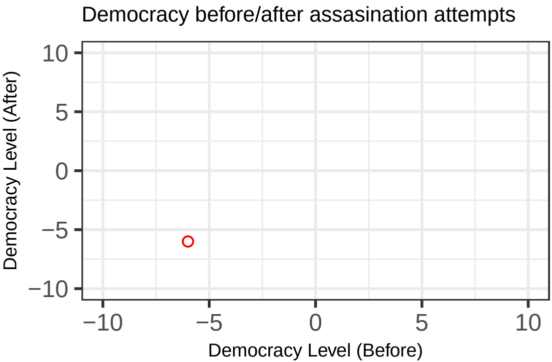
- Each point on the scatterplot (x_i, y_i)
- Use `geom_point()` function in ggplot

```
leaders %>%
  ggplot(aes(x = politybefore, y = polityafter)) +
  geom_point(shape = 21) +
  labs(title = "Democracy before/after assasination attempts",
       x = "Democracy Level (Before)",
       y = "Democracy Level (After)") +
  theme_bw() +
  theme(plot.title = element_text(size=12))
```

Scatterplot

```
leaders[1, c("politybefore","polityafter")]
```

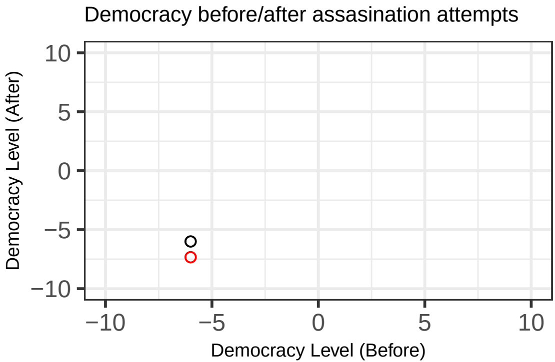
```
##   politybefore polityafter
## 1           -6          -6
```



Scatterplot

```
leaders[2, c("politybefore","polityafter")]
```

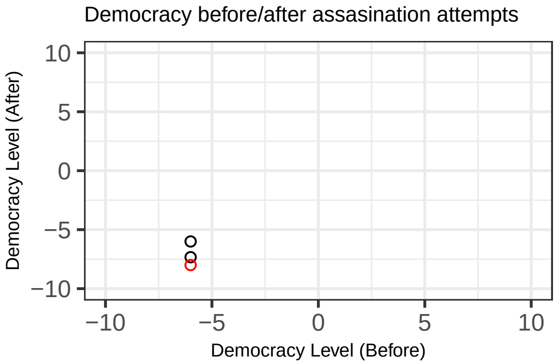
```
##   politybefore polityafter
## 2           -6   -7.333333
```



Scatterplot

```r
leaders[3, c("politybefore","polityafter")]
```

```
##   politybefore polityafter
## 3           -6          -8
```



Scatterplot

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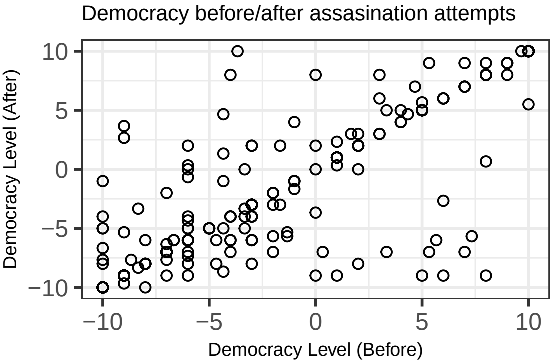
leaders[3, c("politybefore","polityafter")]
```

```
##   politybefore polityafter
## 3           -6          -8
```



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$$\text{z-score of } (ax_i + b) = \text{z-score of } x_i$$

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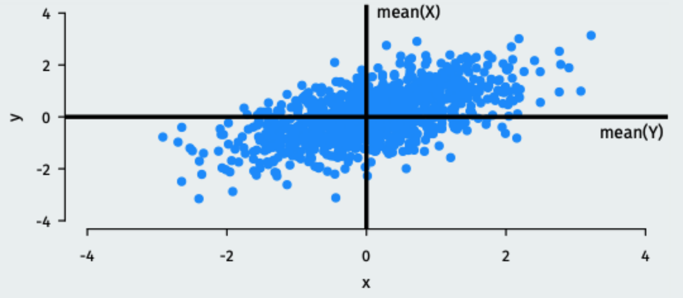
- The technical definition of the **correlation coefficient**:

$$\frac{1}{n-1}\sum_{i=1}^{n}\left[(\text{z-score for } x_i) \times (\text{z-score for } y_i)\right]$$

Correlation intuition:



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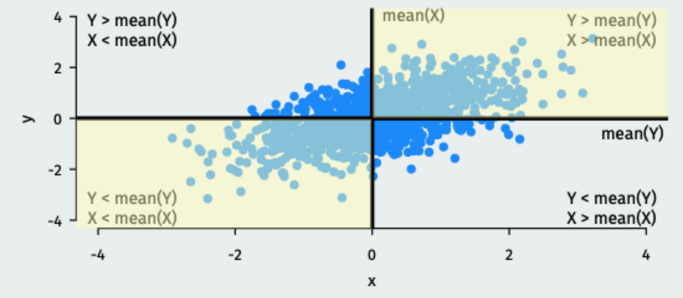

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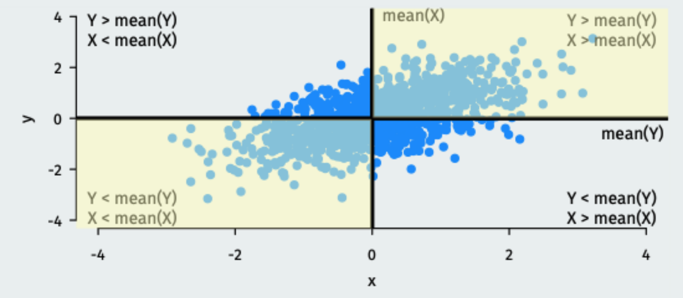

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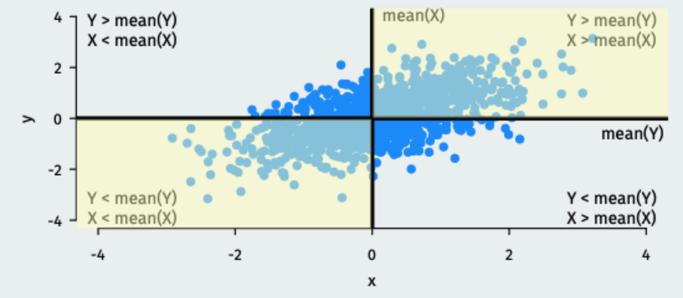

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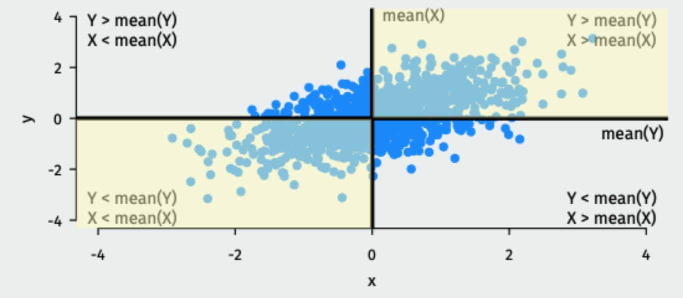

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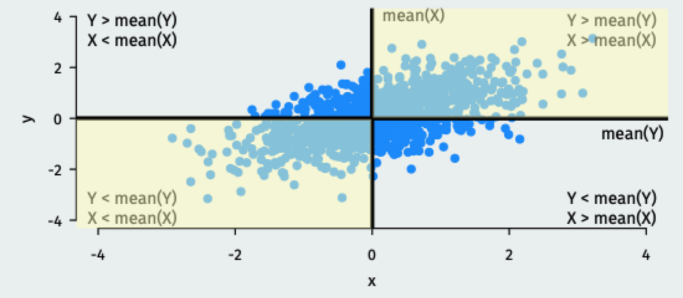

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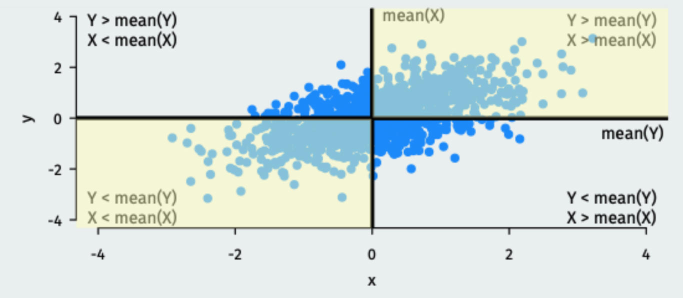

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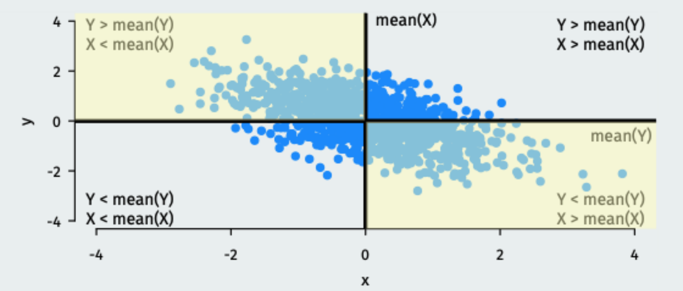

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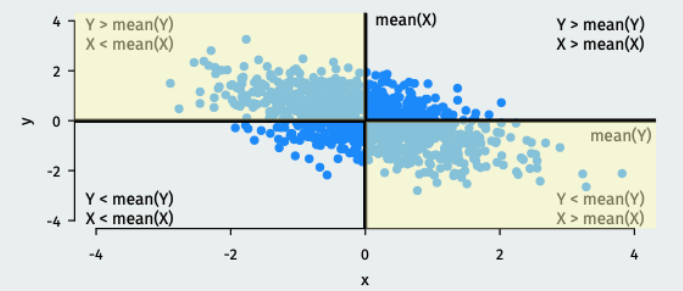

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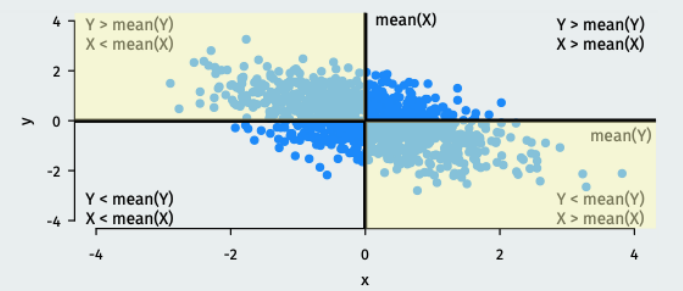

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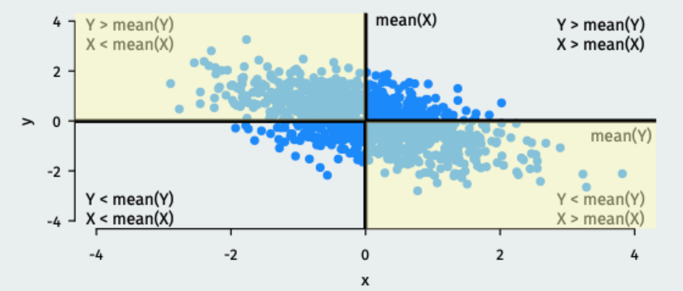

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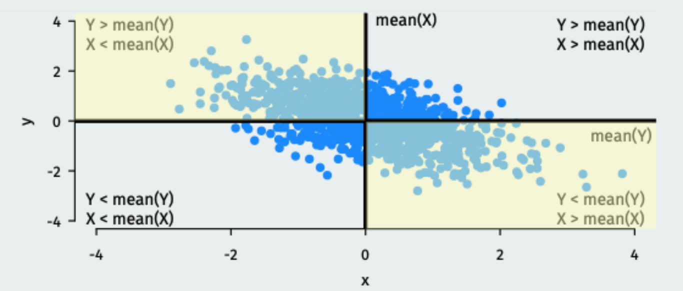

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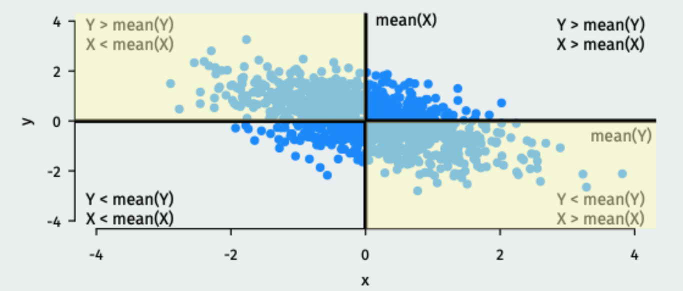

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- Not affected by changes of scale:
  - $\texttt{cor}(x,y) = \texttt{cor}(ax+b, cy+d)$
  - Celsius vs. Fahrenheit; dollars vs. pesos; cm vs. in.

Correlation in R

- Use the `cor()` function
- Missing values: set the `use = "pairwise"` ⇝ available case analysis

```
leaders %>%
  select(politybefore, polityafter) %>%
  cor()
```

```
##              politybefore polityafter
## politybefore    1.0000000   0.8283237
## polityafter     0.8283237   1.0000000
```

-Very highly correlated!