Gov 50: 8. Measurement: Summarizing Bivariate Relationships

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Harvard University

Fall 2018

1. Today's agenda

2. Investigating fraud

3. Bivariate relationships

1/ Today's agenda

Logistics

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- Midterm course evaluations after the midterm.

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2/ Investigating fraud

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  - panel data: baseline plus 6 waves.

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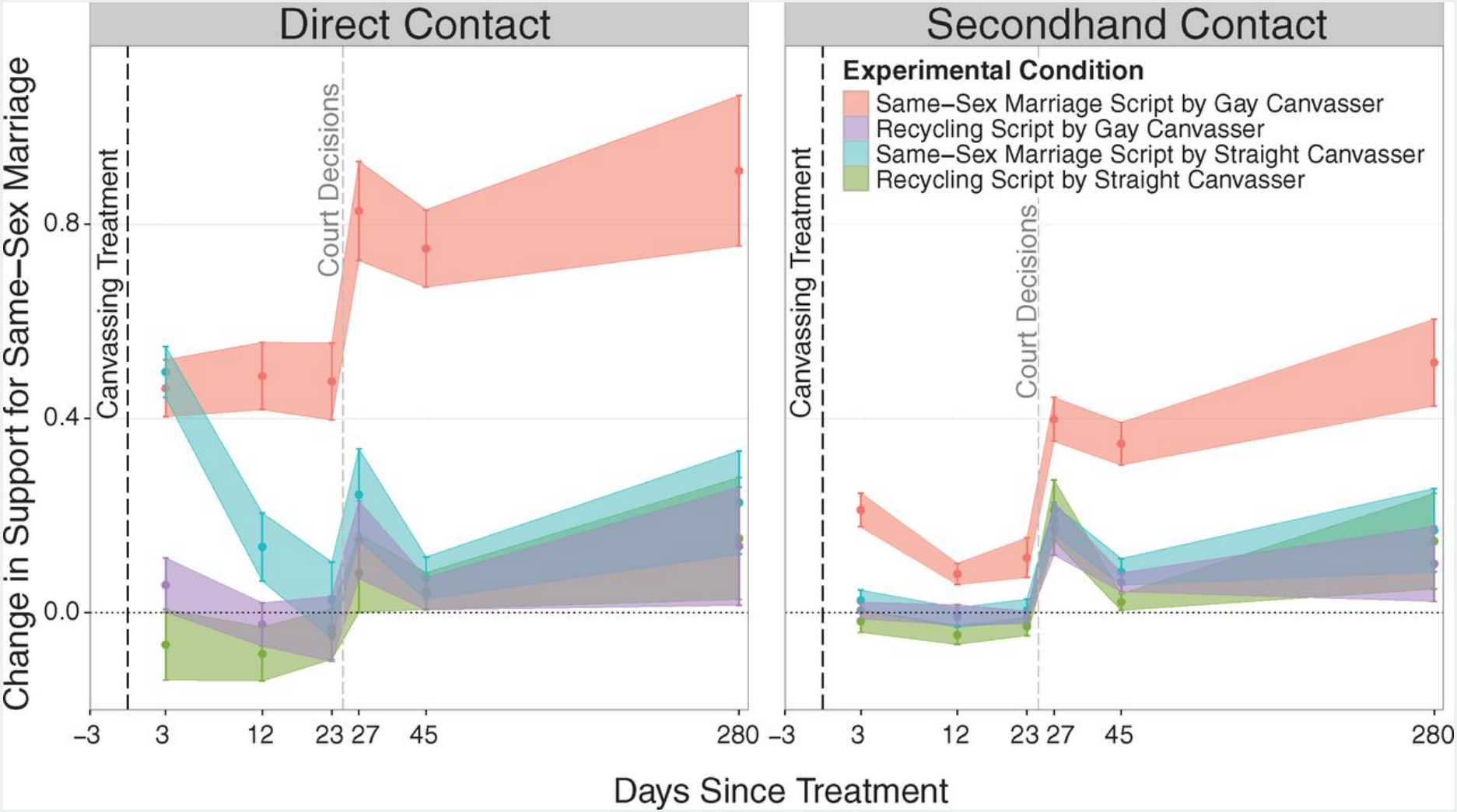
  - support for same-sex marriage.
  - feeling toward gay people.

Big and lasting effects of persuasion



Reshaped data

Name	Description
study	Which study is the data from (1 = Study1, 2 = Study2)
treatment	Five possible treatment assignment options
therm1	Survey thermometer rating of feeling towards gay couples in waves 1 (0–100)
therm2	Survey thermometer rating of feeling towards gay couples in waves 2 (0–100)
therm3	Survey thermometer rating of feeling towards gay couples in waves 3 (0–100)
therm4	Survey thermometer rating of feeling towards gay couples in waves 4 (0–100)

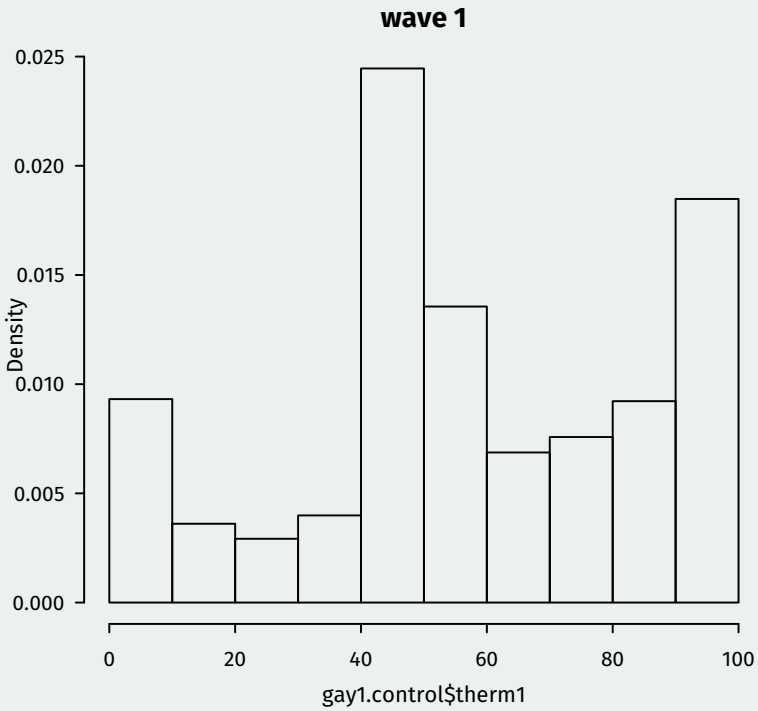
```
gay.reshaped <- read.csv("data/gayreshaped.csv")
names(gay.reshaped)
```

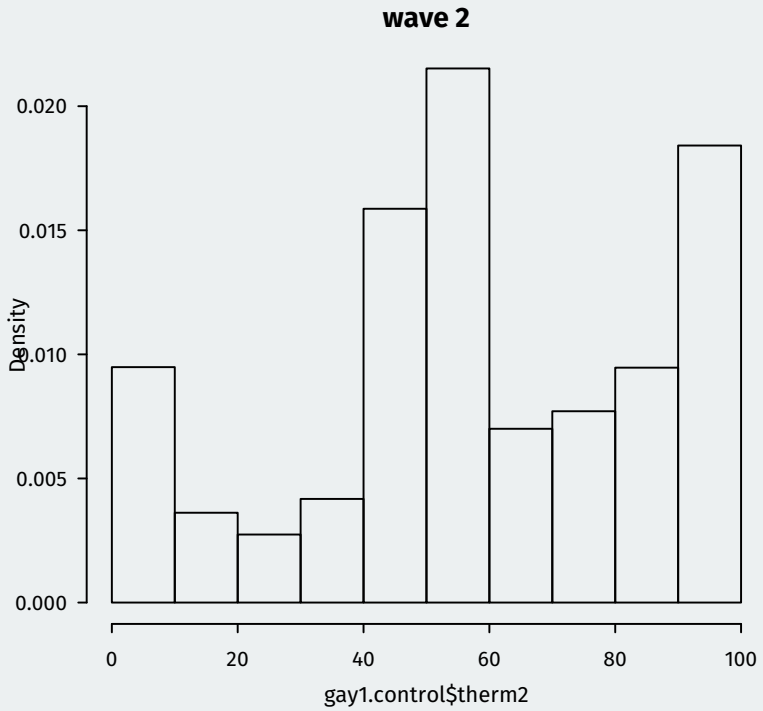
```
## [1] "study"     "treatment" "therm1"    "therm2"
## [5] "therm3"    "therm4"
```

Comparison of gay thermometer across waves

- Compare between waves 1 and 2 for the control group in Study 1:

```
gay1.control <- subset(gay.reshaped, (study == 1) &
                           (treatment == "No Contact"))
hist(gay1.control$therm1, freq = FALSE, main = "wave 1")
hist(gay1.control$therm2, freq = FALSE, main = "wave 2")
```





3/ Bivariate relationships

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```
plot(x = gay1.control$therm1, y = gay1.control$therm2,
     xlab = "Wave 1", ylab = "Wave 2")
```

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```
gay1.control[1, c("therm1", "therm2")]
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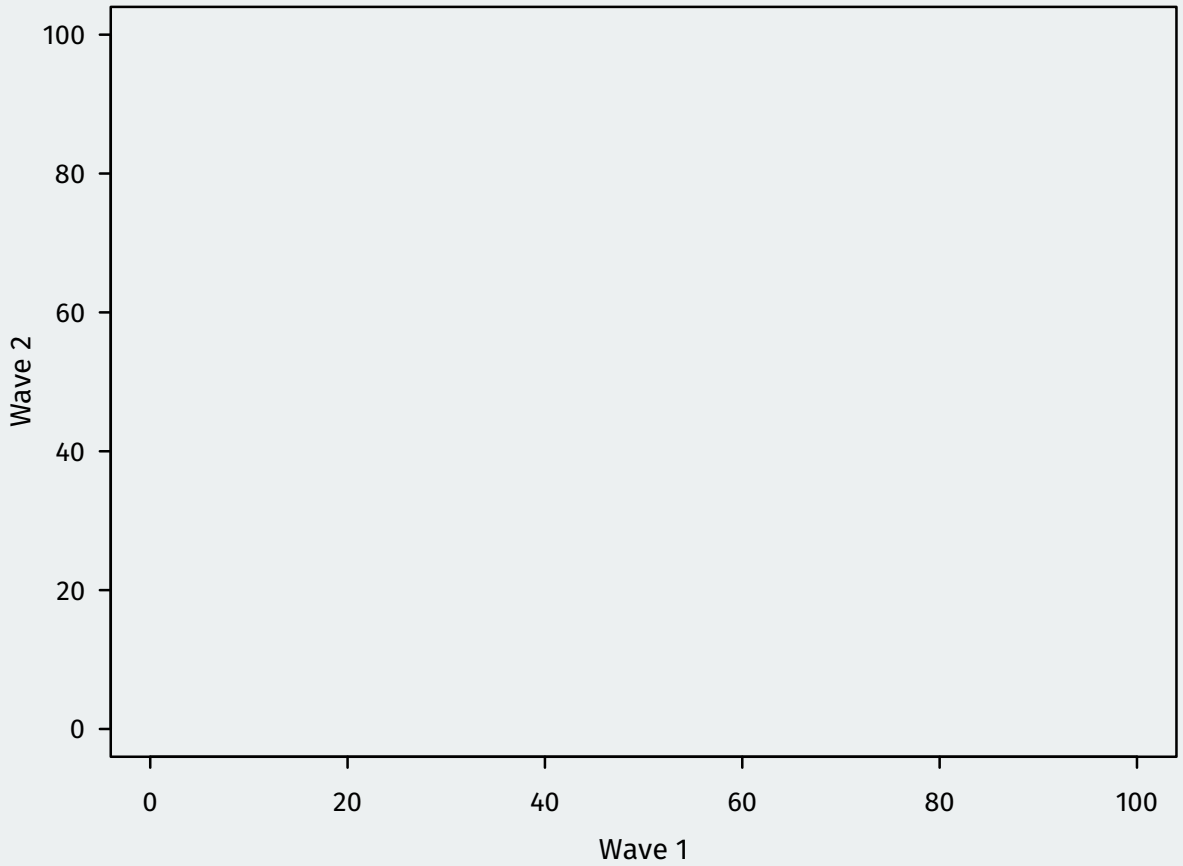

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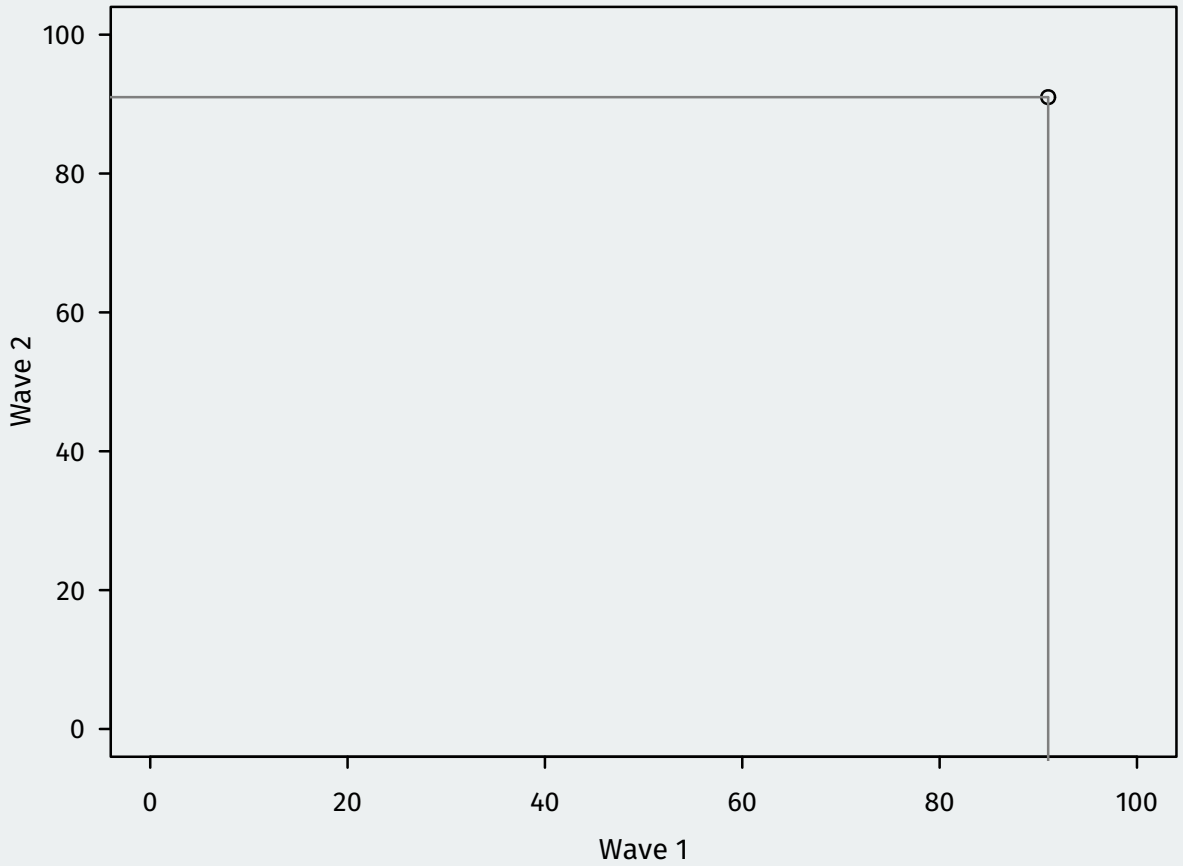

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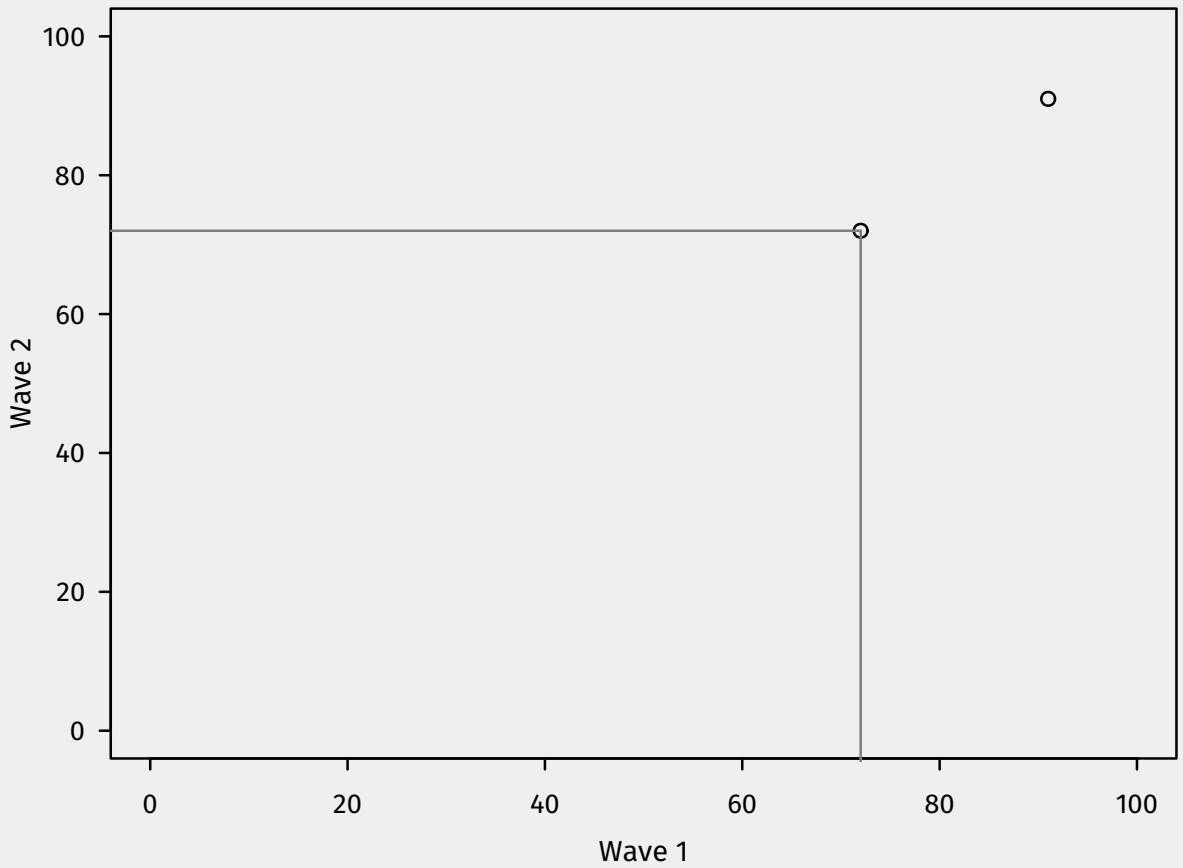
```
gay1.control[2, c("therm1", "therm2")]
```

```
##   therm1 therm2
## 2     72     72
```



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```
gay1.control[3, c("therm1", "therm2")]
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```
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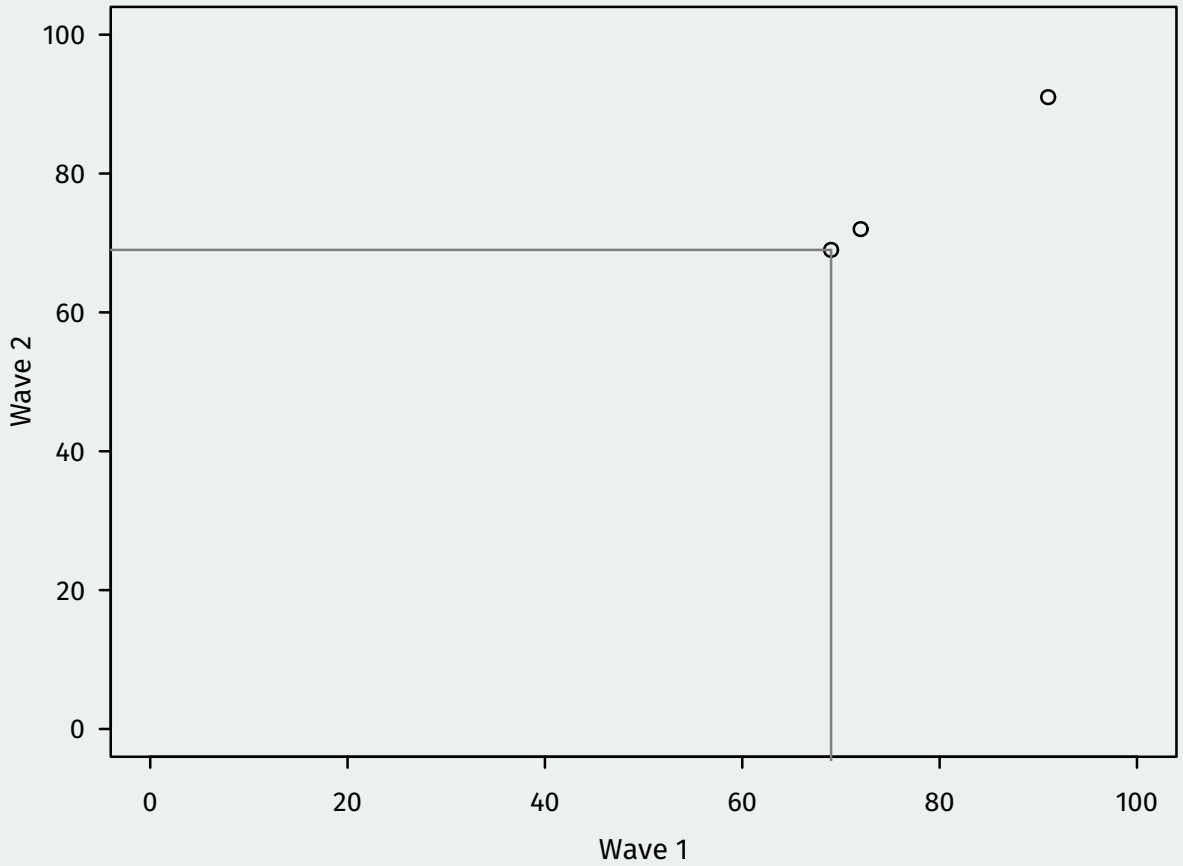

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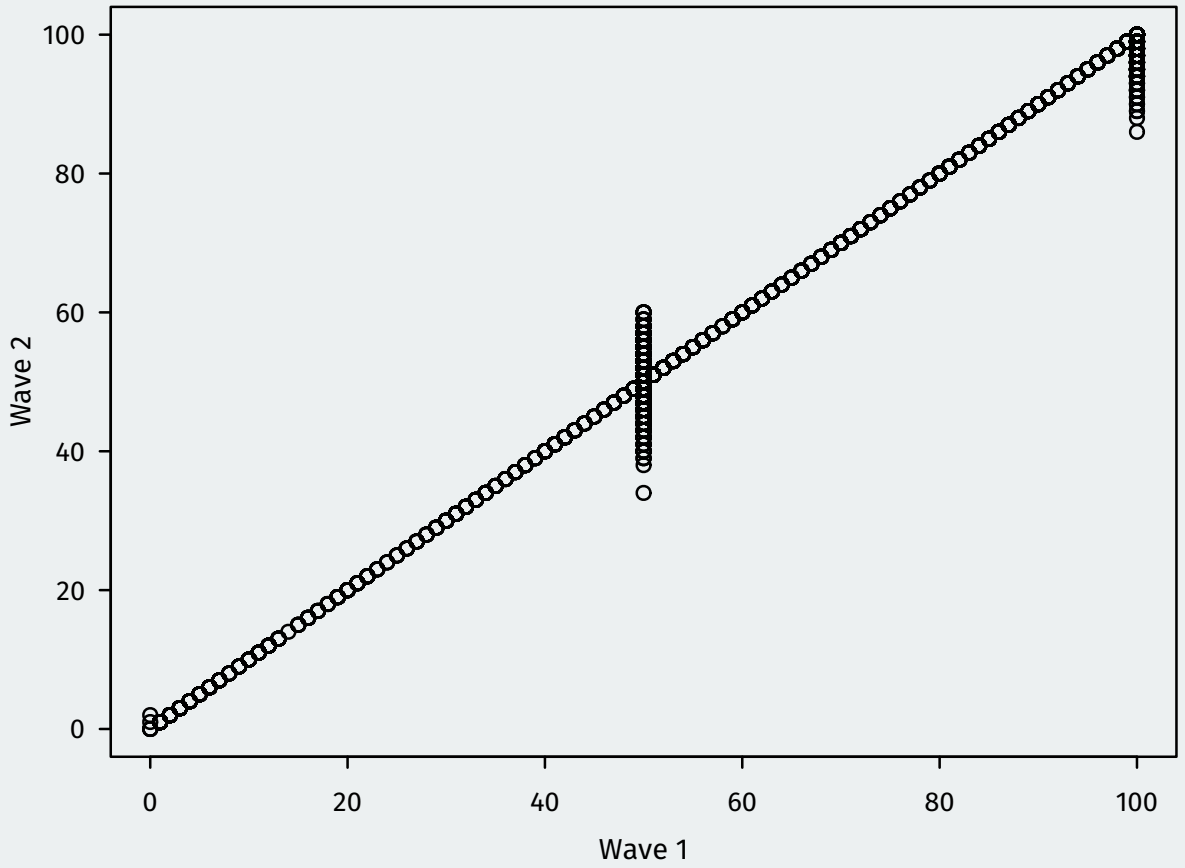

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- **z-score**:

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- z-scores don't depend on units:

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

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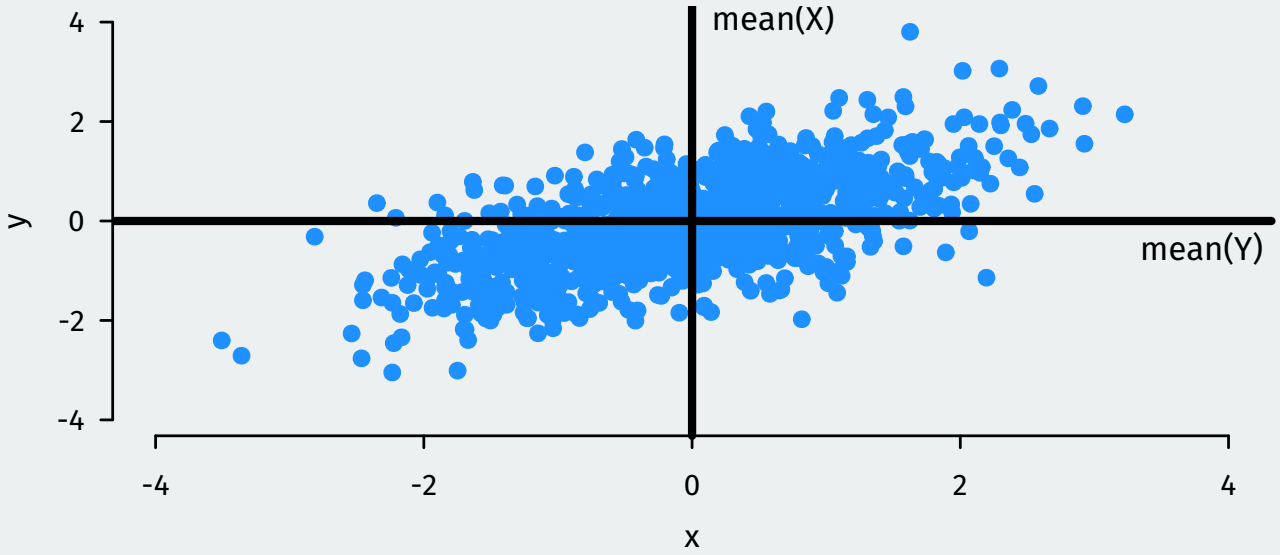
  - High correlation: data cluster tightly around a line.
- The technical definition of the **correlation coefficient**:

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

Correlation intuition



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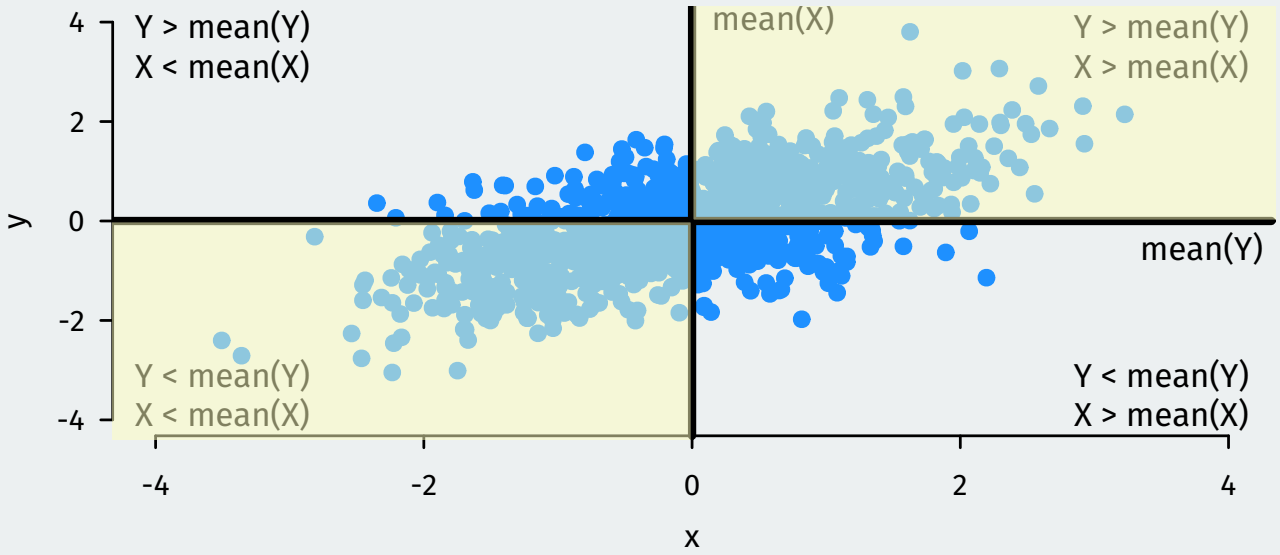

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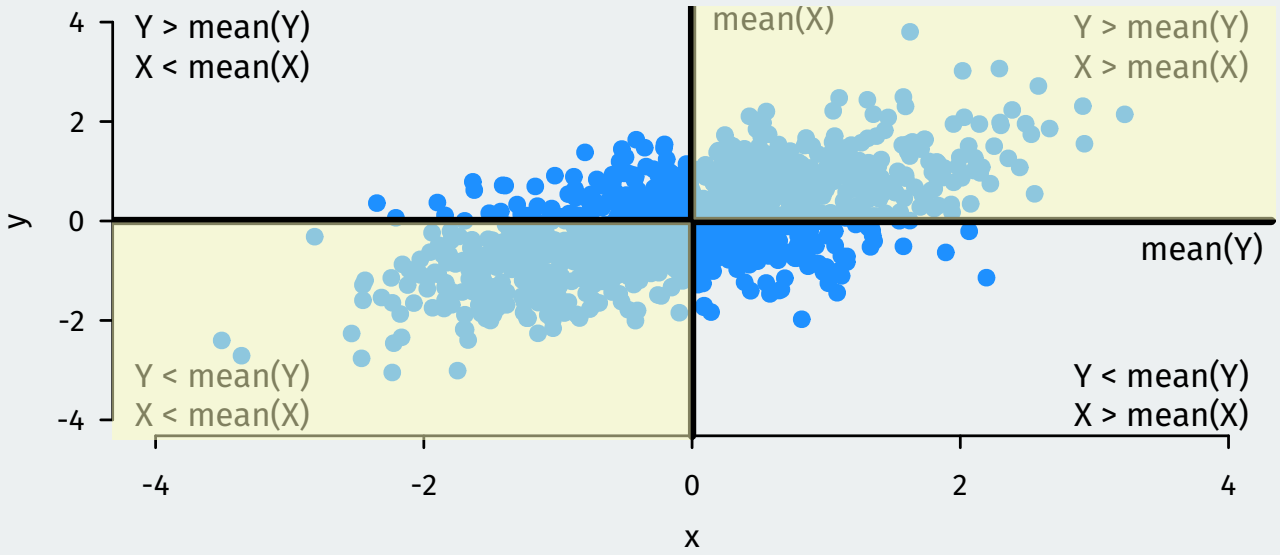

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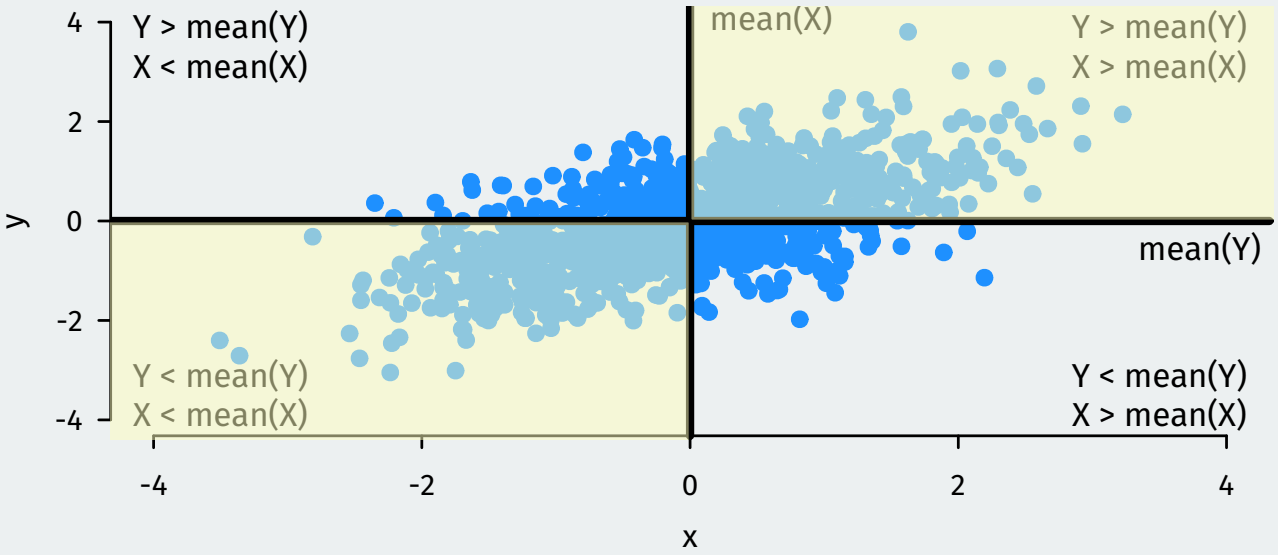

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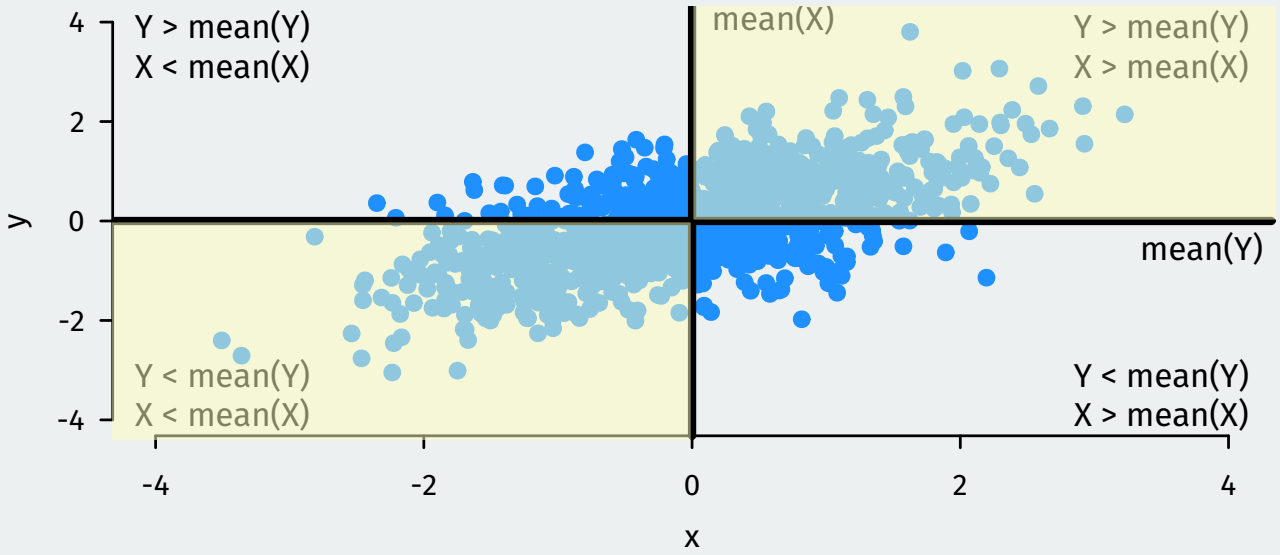

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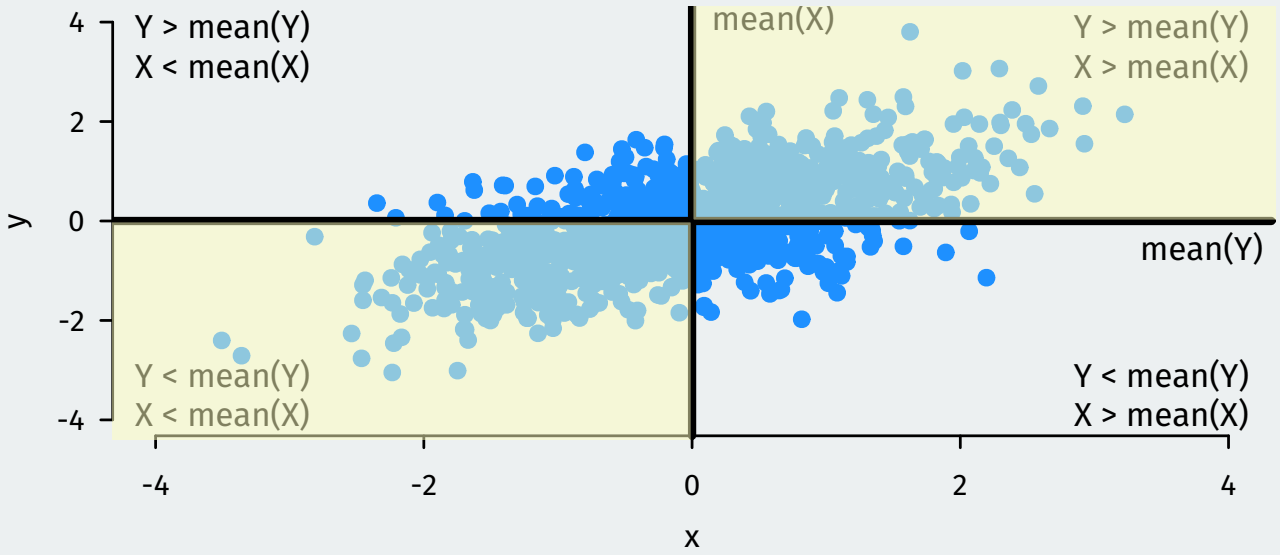

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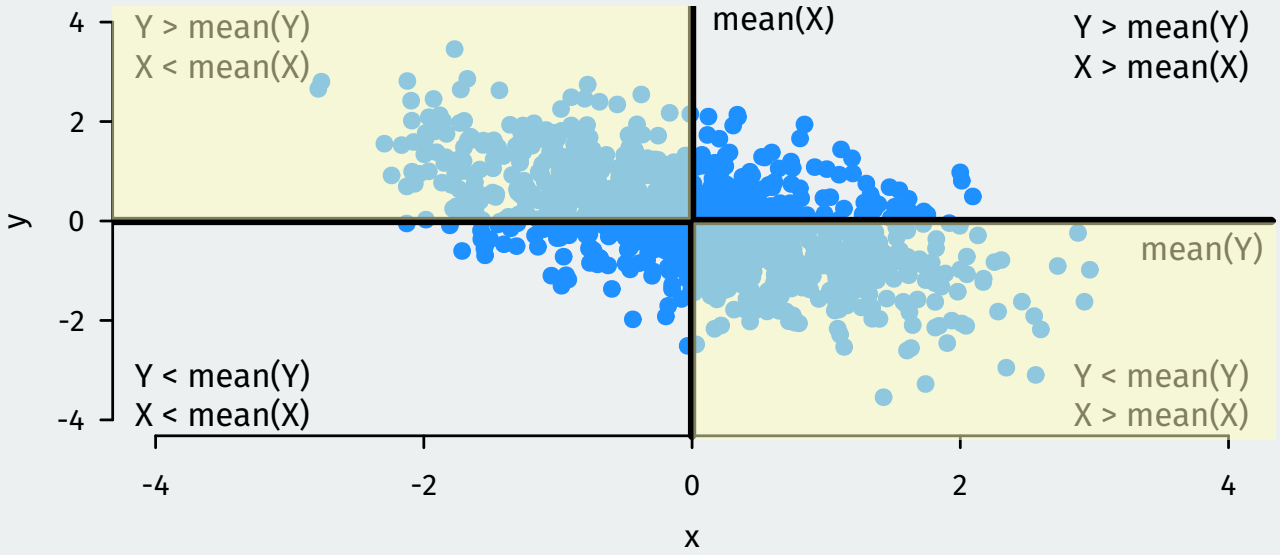

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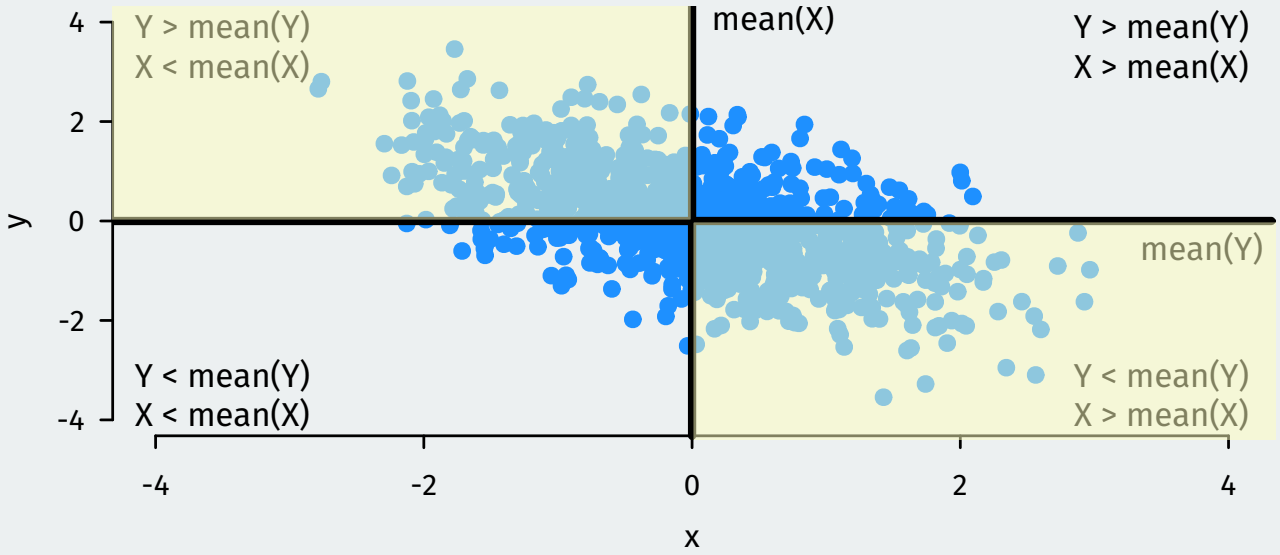

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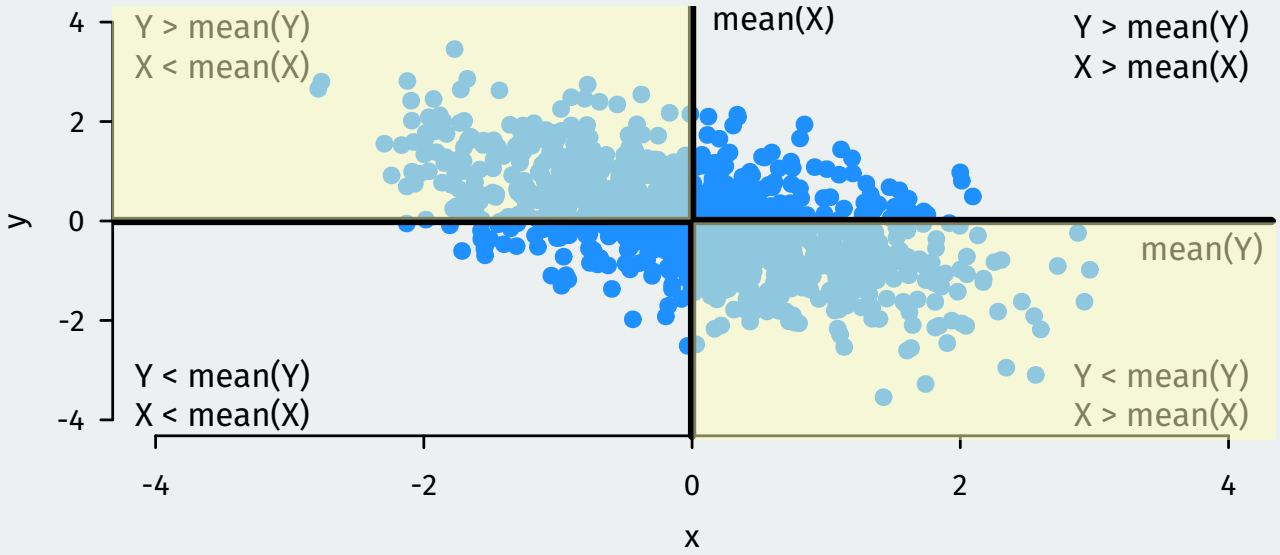

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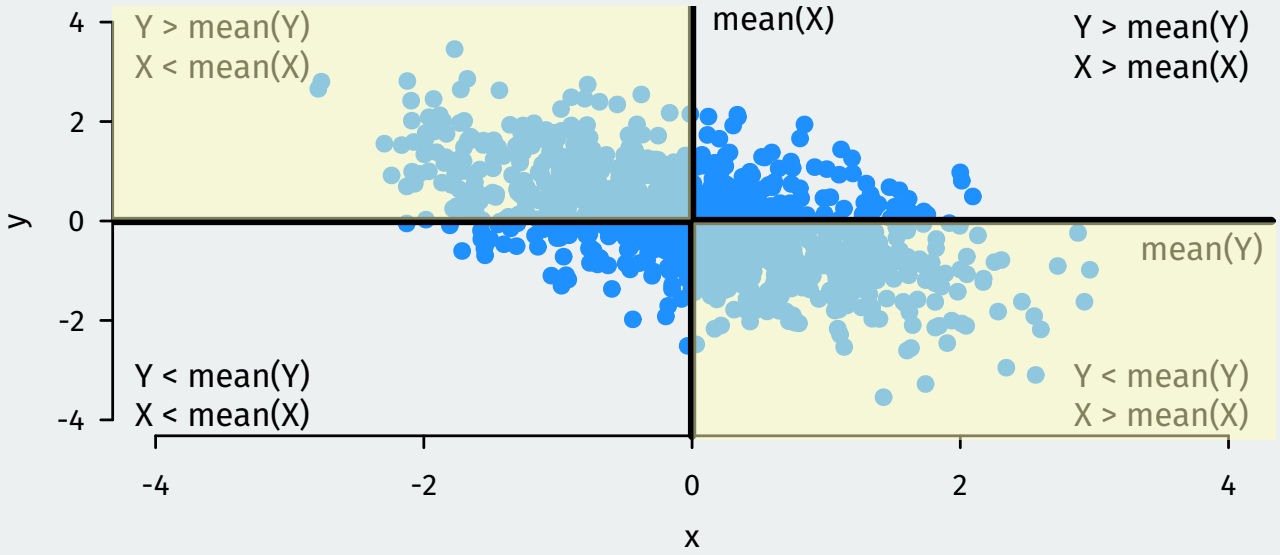

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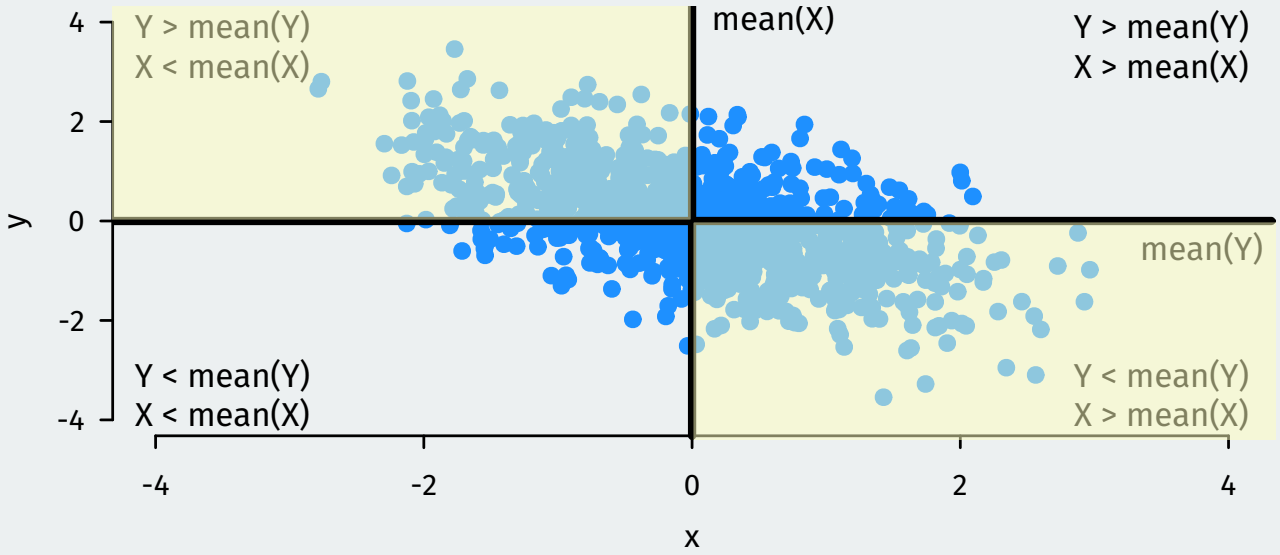

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- Not affected by changes of scale:

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- Correlation measures **linear** association.
- Interpretation:
  - Correlation is between -1 and 1
  - Correlation of 0 means no linear association.
  - Positive correlations $\rightsquigarrow$ positive associations.
  - Negative correlations $\rightsquigarrow$ negative associations.
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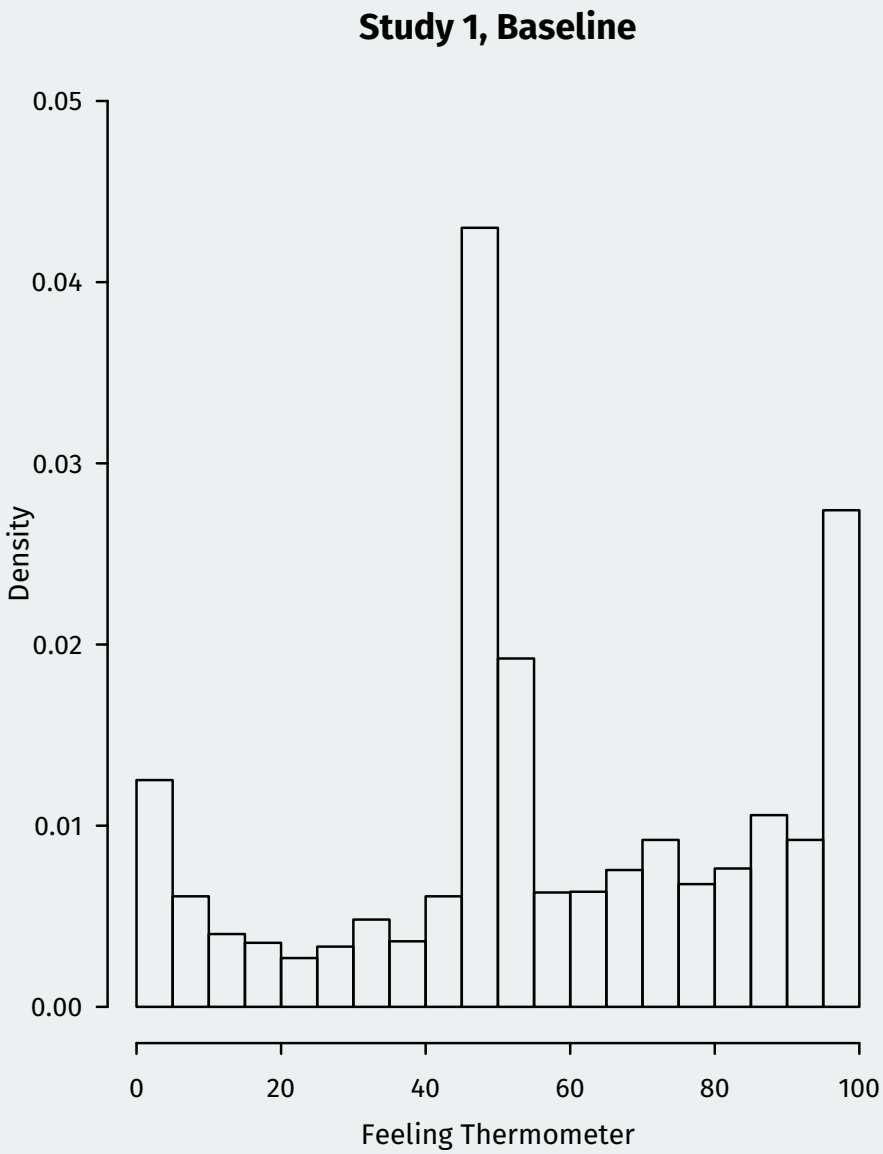
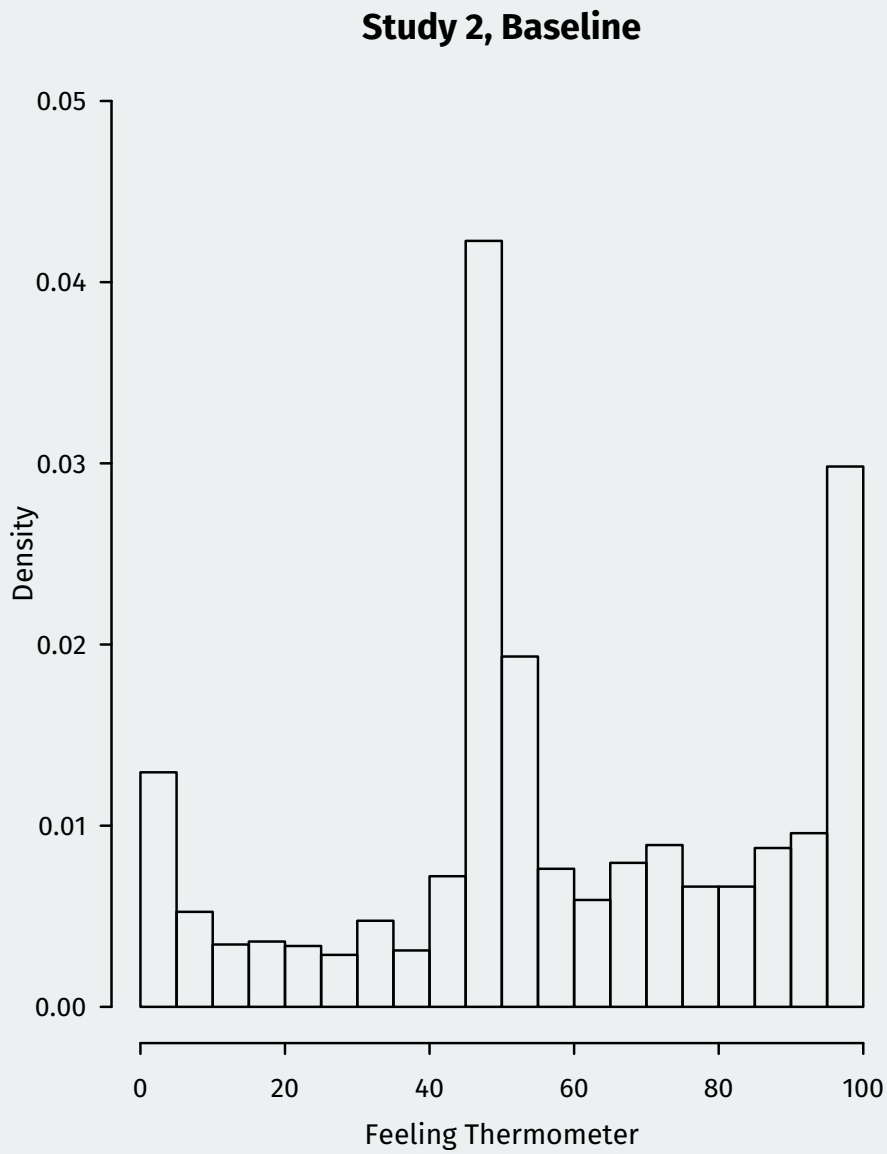
```
hist(gay1$therm1, freq = FALSE, breaks = 20,
 ylim = c(0, 0.05), xlab = "Feeling Thermometer",
 main = "Study 1, Baseline")
hist(gay2$therm1, freq = FALSE, breaks = 20,
  ylim = c(0, 0.05), xlab = "Feeling Thermometer",
  main = "Study 2, Baseline")
```

Very similar!!





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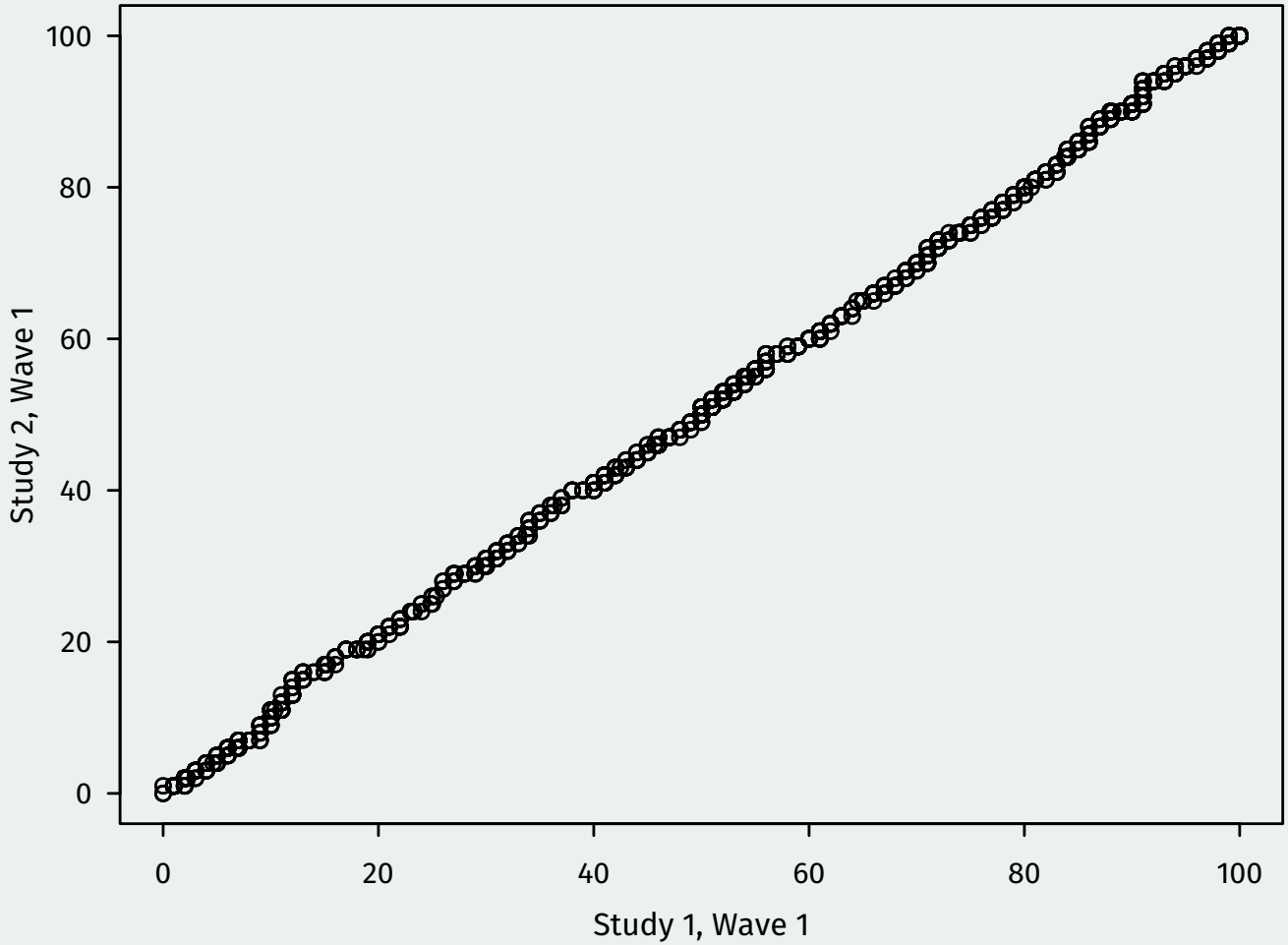
  - (25th percentile of X, 25th percentile of Y)
- 45 degree line indicates quality of the two distributions.

QQ-plot example

```
qqplot(gay1$therm1, gay2$therm1, xlab = "Study 1, Wave 1",
       ylab = "Study 2, Wave 1")
```



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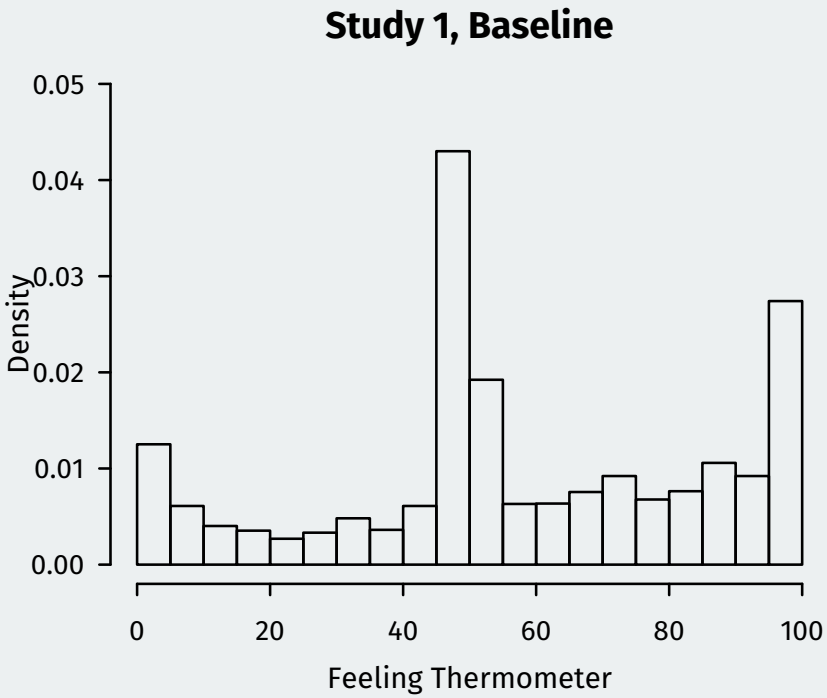
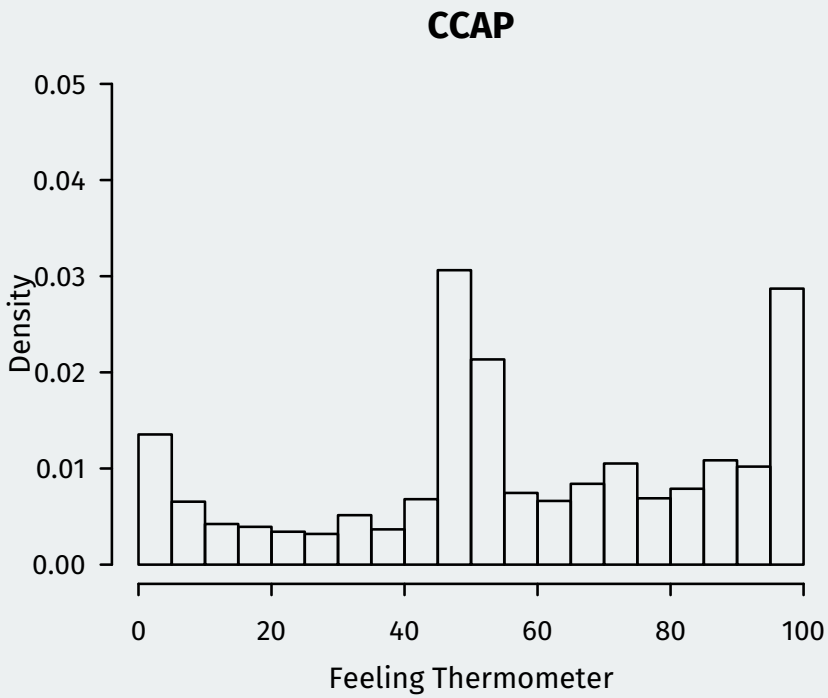
Comparison of CCAP and Study 1





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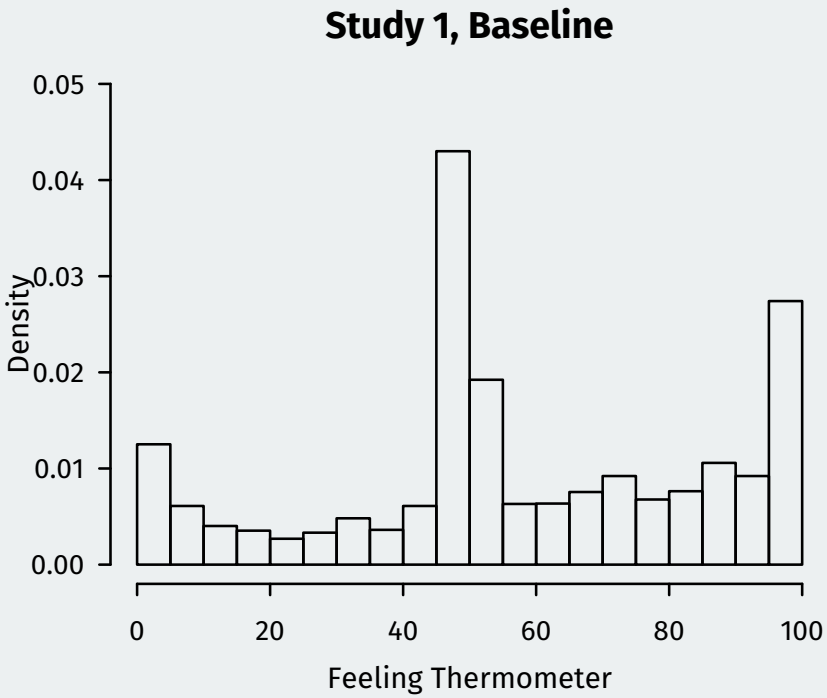

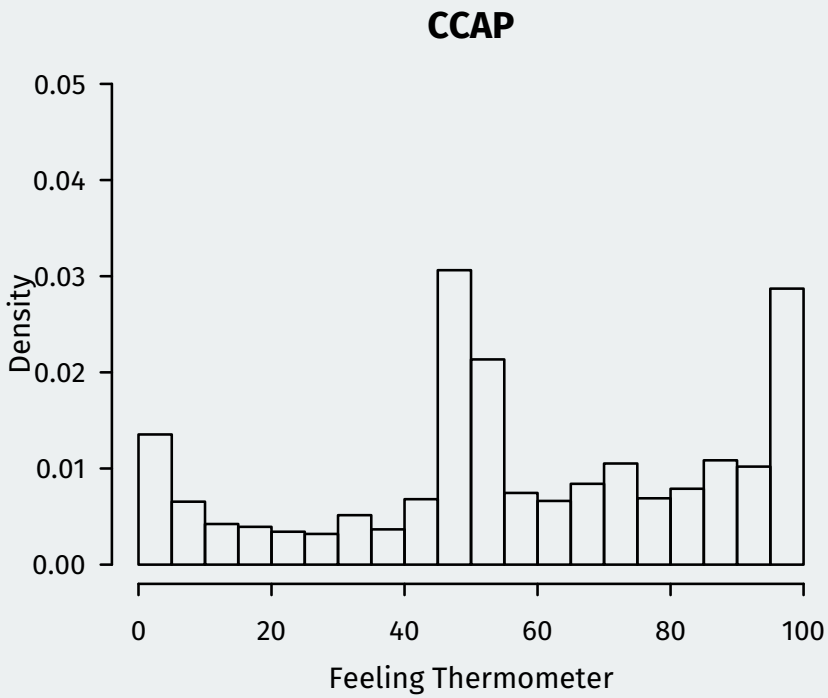

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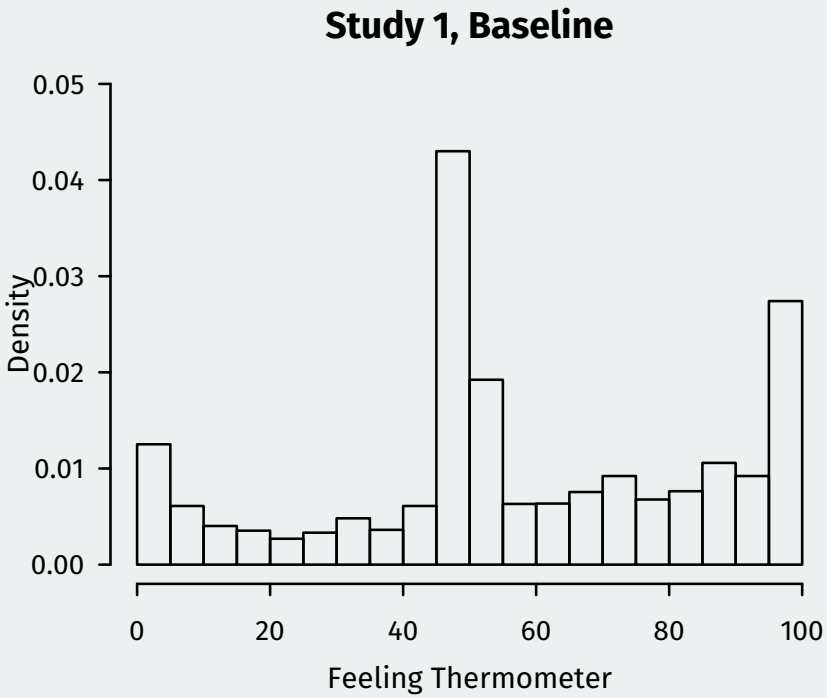
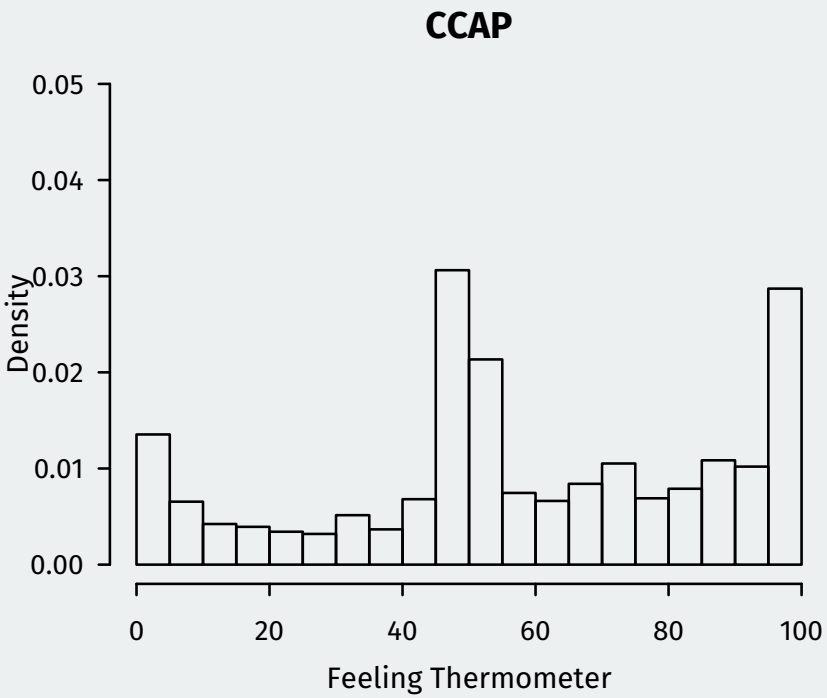
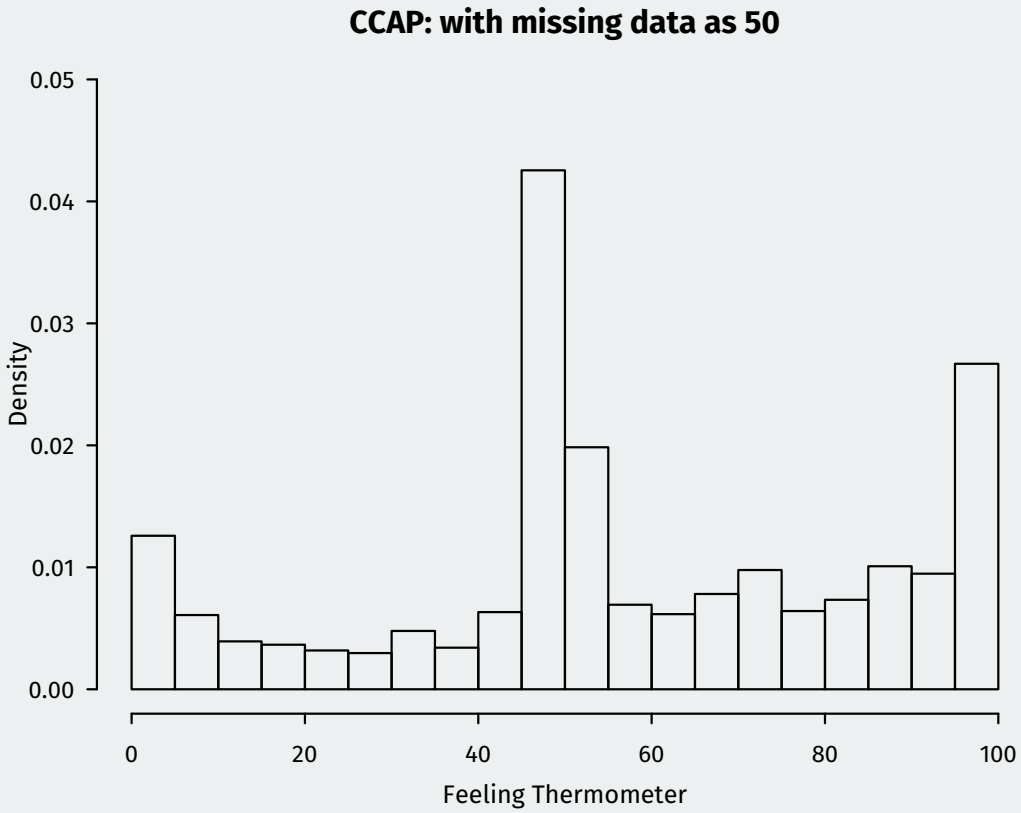




- Suspiciously similar!
- What's the difference?

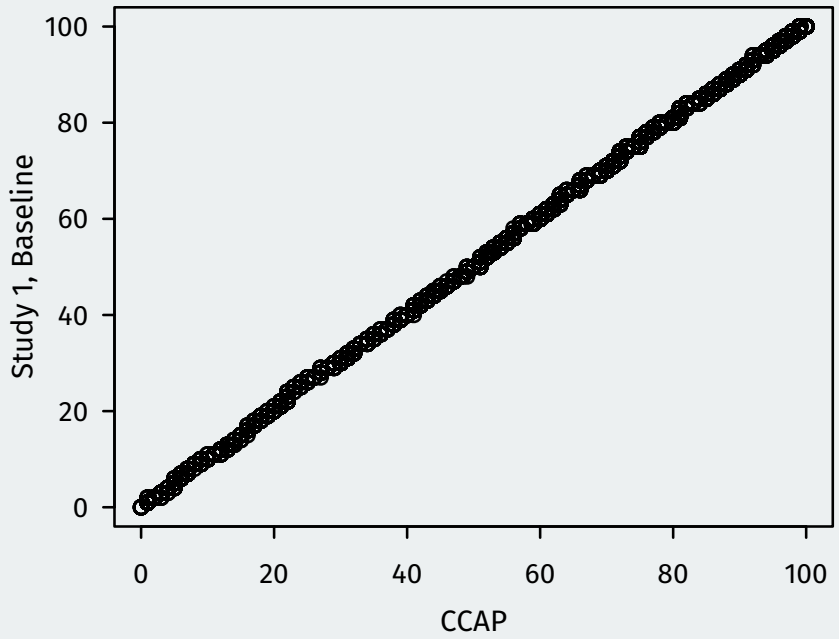
Recoding missing as 50s

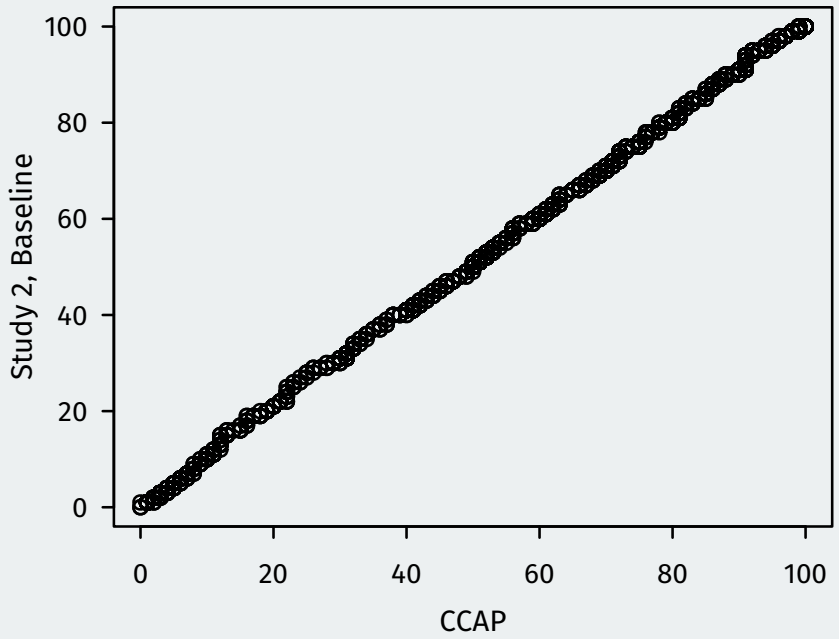
```
ccap$gaytherm[is.na(ccap$gaytherm)] <- 50
hist(ccap$gaytherm, freq = FALSE,
     ylim = c(0, 0.05), xlab = "Feeling Thermometer",
     main = "CCAP: with missing data as 50")
```



QQ plots reveal extreme similarity

```
qqplot(ccap$gaytherm, gay1$therm1, xlab = "CCAP",
       ylab = "Study 1, Baseline")
qqplot(ccap$gaytherm, gay2$therm1, xlab = "CCAP",
       ylab = "Study 2, Baseline")
```





Retraction

SCIENCE 359 COMMENTS

Doubts About Study of Gay Canvassers Rattle the Field

By BENEDICT CAREY and PAM BELLUCK MAY 25, 2015

Donald P. Green, left, a co-author of a challenged study by Michael LaCour, right, from Mr. LaCour's Facebook page.

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