Tidy Data I

Intro to Tidy Data

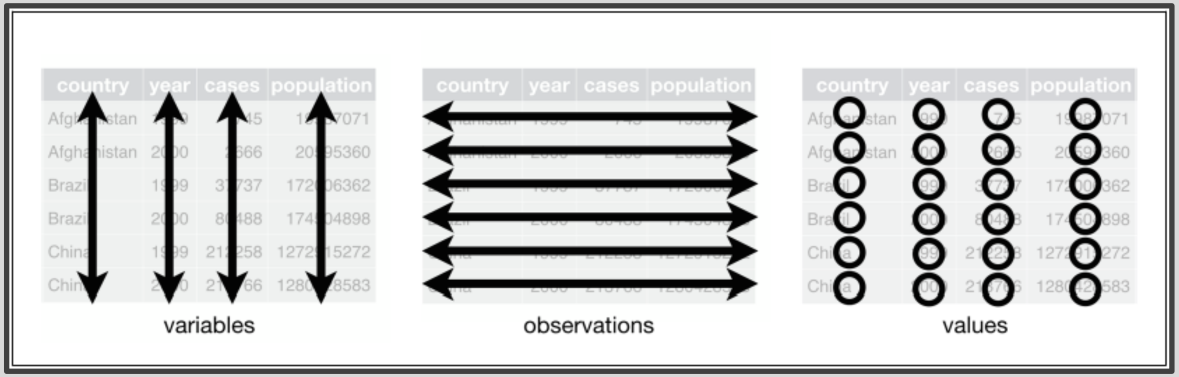
- Read Chapter 9
- Functions From tidyr Package

```
>library(tidyr)
```

  - gather()
  - spread()
  - separate()
  - unite()
  - complete()
  - fill()
- Consider Chapter 5 in 2nd Edition
  - pivot_longer()
  - pivot_wider()

Tidy Data Defined

- For Tidy Data:
  - Each Variable Must Have Its Own Column
  - Each Observation Must Have Its Own Row
  - Each Value Must Have Its Own Cell



Problem

- Most Data is Not Tidy

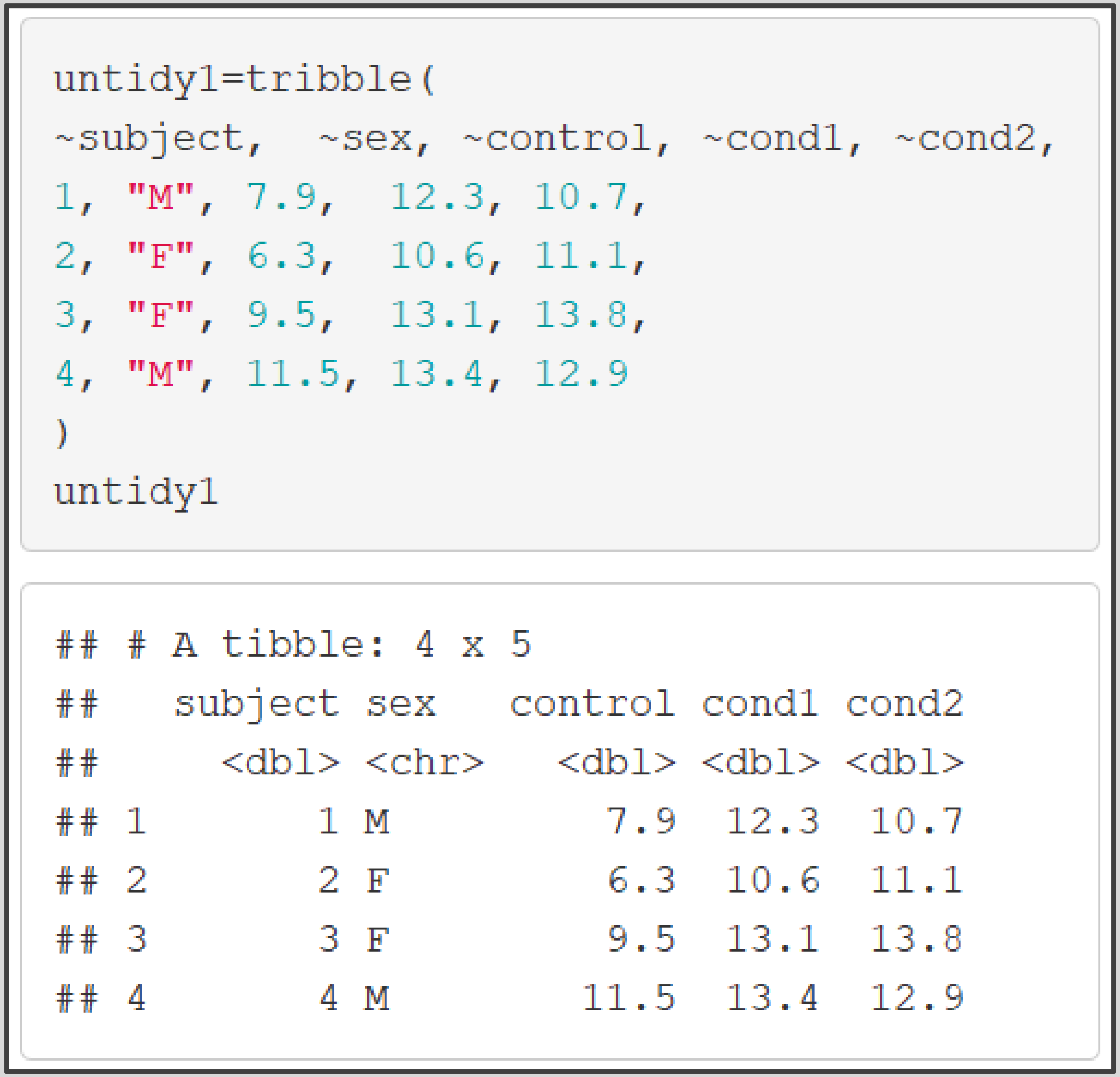
- Reason: Data Collectors Often Don’t Know How Data Should Be Recorded Since They Don’t Analyze the Data

- Common Problems
  - A Variable Spread Across Multiple Columns
  - A Observation is Spread Across Multiple Rows

- *“Until we can fix people we must fix the data”*

  – Mahatma Mario

Untidy Data Example 1



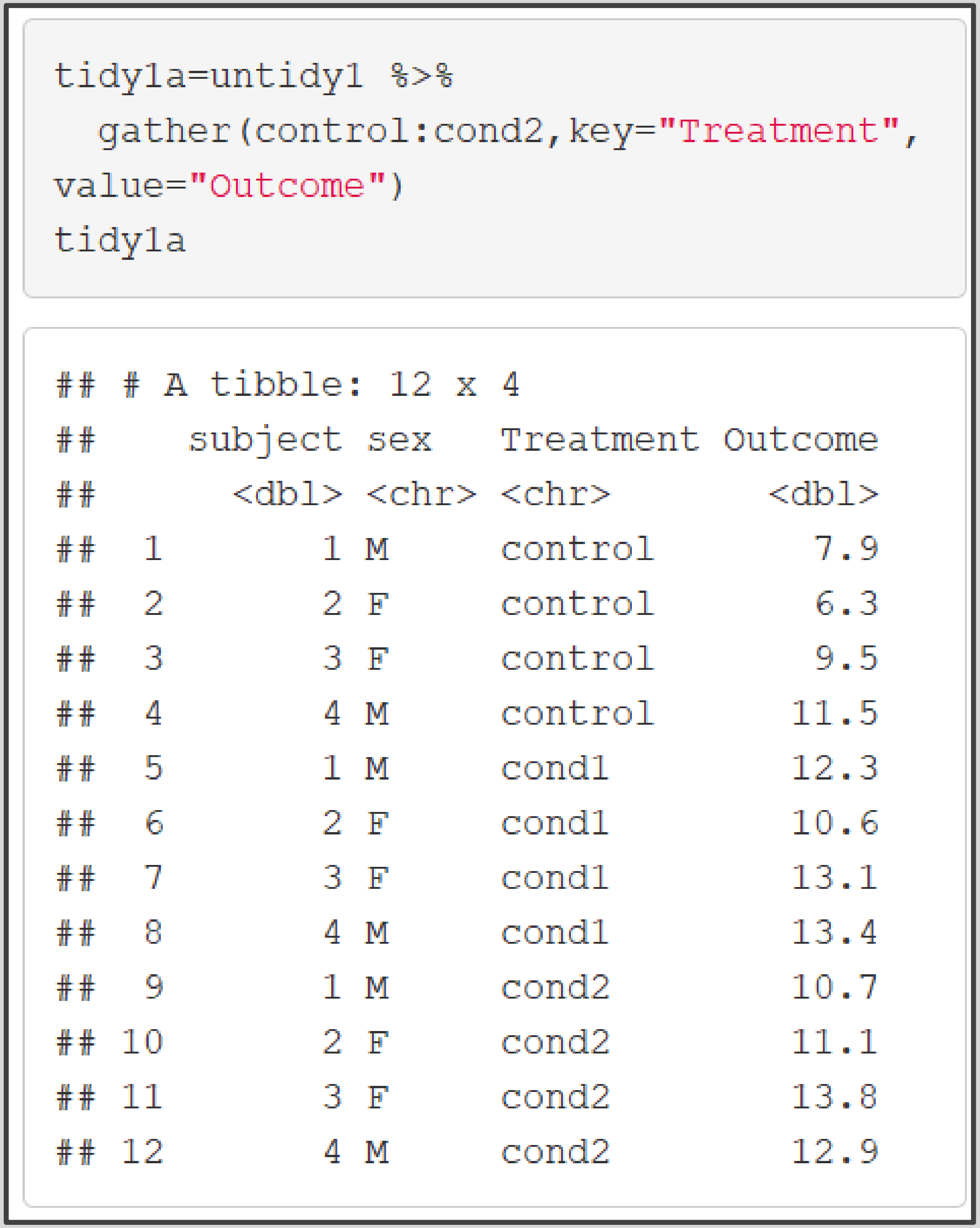
```
untidy1=tribble(
~subject,  ~sex, ~control, ~cond1, ~cond2,
1, "M", 7.9,  12.3, 10.7,
2, "F", 6.3,  10.6, 11.1,
3, "F", 9.5,  13.1, 13.8,
4, "M", 11.5, 13.4, 12.9
)
untidy1
```

```
## # A tibble: 4 x 5
##   subject sex   control cond1 cond2
##     <dbl> <chr>   <dbl> <dbl> <dbl>
## 1       1 M         7.9  12.3  10.7
## 2       2 F         6.3  10.6  11.1
## 3       3 F         9.5  13.1  13.8
## 4       4 M        11.5  13.4  12.9
```

Gathering

- Multiple Treatment Data
- Variables “Control”, “Cond1”, and “Cond2” are Measuring the Same Thing Under Different Treatments
- The Name of the Variable Whose Values Form the Column Names Can Be Called “Treatment”
- The Name of the Variable Whose Values are Spread Over the Cells Can Be Called “Outcome”

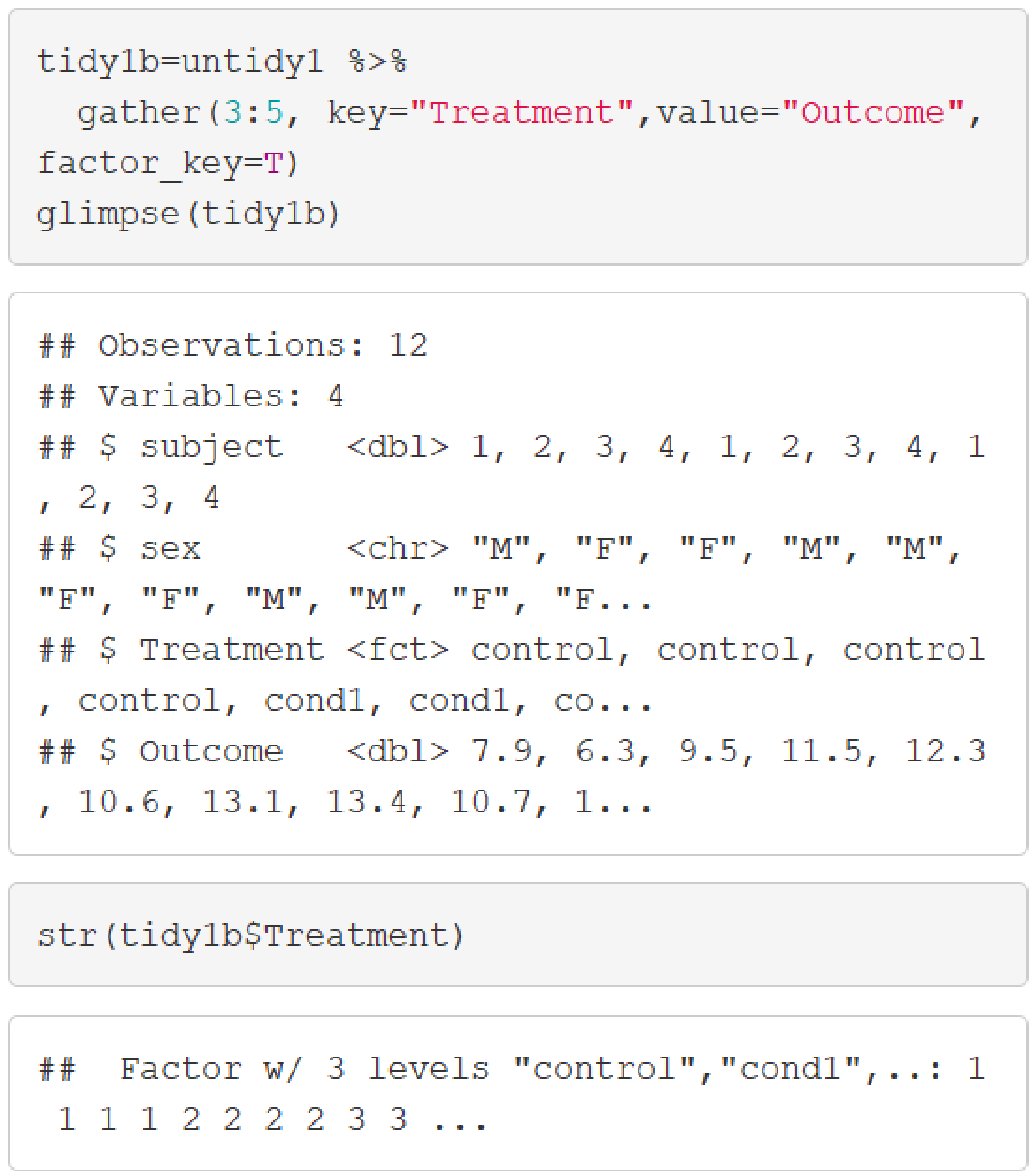
Gathering



```
tidy1a=untidy1 %>%
  gather(control:cond2,key="Treatment",
value="Outcome")
tidy1a
```

```
## # A tibble: 12 x 4
##    subject sex   Treatment Outcome
##      <dbl> <chr> <chr>       <dbl>
##  1       1 M     control       7.9
##  2       2 F     control       6.3
##  3       3 F     control       9.5
##  4       4 M     control      11.5
##  5       1 M     cond1        12.3
##  6       2 F     cond1        10.6
##  7       3 F     cond1        13.1
##  8       4 M     cond1        13.4
##  9       1 M     cond2        10.7
## 10       2 F     cond2        11.1
## 11       3 F     cond2        13.8
## 12       4 M     cond2        12.9
```

Gathering



```
tidy1b=untidy1 %>%
  gather(3:5, key="Treatment",value="Outcome",
factor_key=T)
glimpse(tidy1b)
```

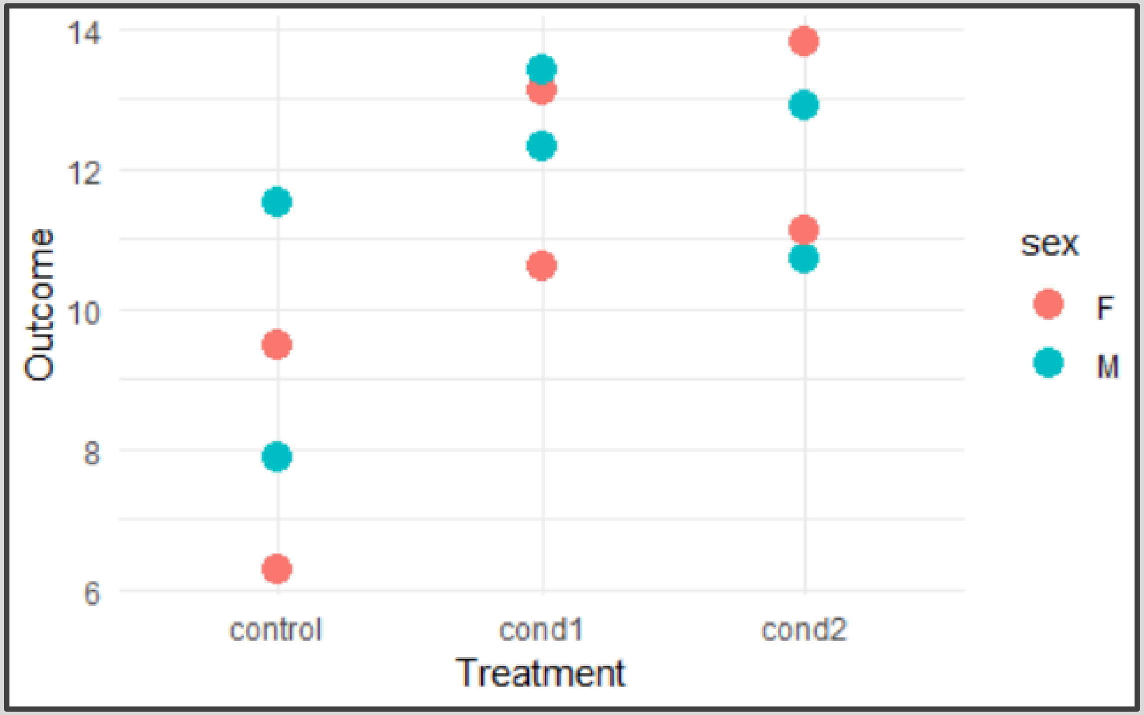
```
## Observations: 12
## Variables: 4
## $ subject   <dbl> 1, 2, 3, 4, 1, 2, 3, 4, 1
, 2, 3, 4
## $ sex       <chr> "M", "F", "F", "M", "M",
"F", "F", "M", "M", "F", "F...
## $ Treatment <fct> control, control, control
, control, cond1, cond1, co...
## $ Outcome   <dbl> 7.9, 6.3, 9.5, 11.5, 12.3
, 10.6, 13.1, 13.4, 10.7, 1...
```

```
str(tidy1b$Treatment)
```

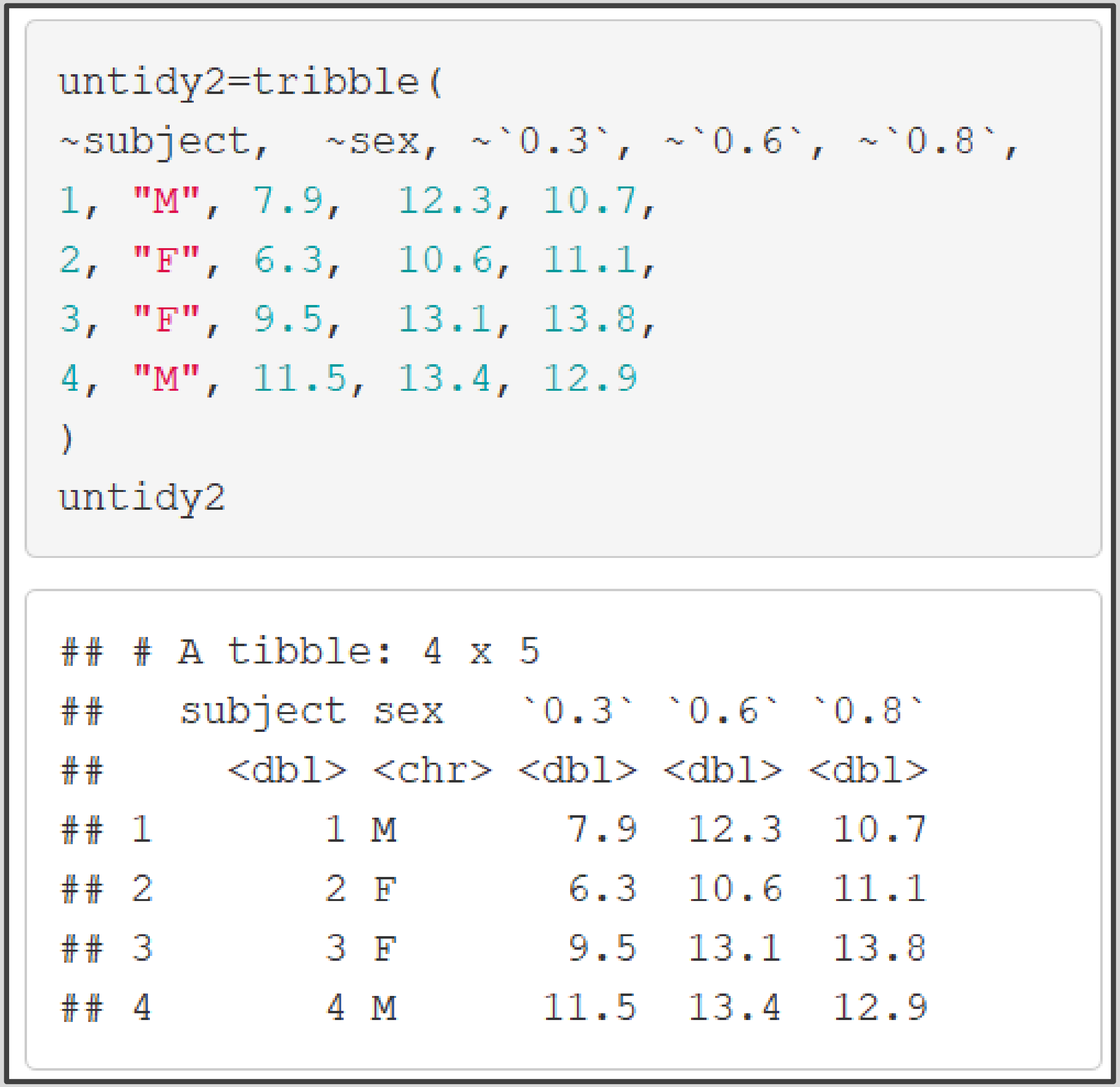
```
##  Factor w/ 3 levels "control","cond1",..: 1
 1 1 1 2 2 2 2 3 3 ...
```

Gathering

- Why Do This Nonsense?



Untidy Data Example 2



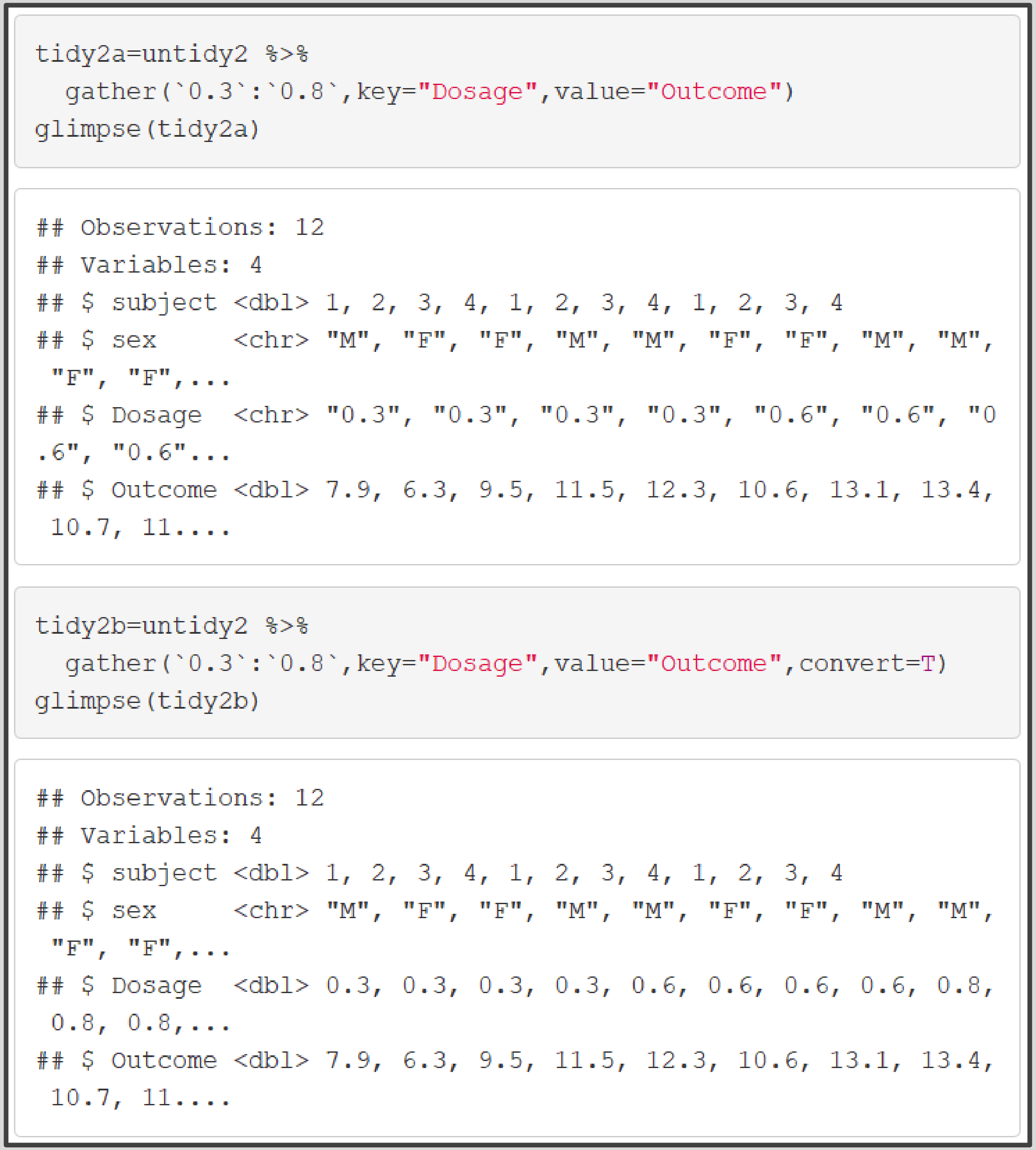
```
untidy2=tribble(
~subject,  ~sex, ~`0.3`, ~`0.6`, ~`0.8`,
1, "M", 7.9,  12.3, 10.7,
2, "F", 6.3,  10.6, 11.1,
3, "F", 9.5,  13.1, 13.8,
4, "M", 11.5, 13.4, 12.9
)
untidy2
```

```
## # A tibble: 4 x 5
##   subject sex   `0.3` `0.6` `0.8`
##     <dbl> <chr> <dbl> <dbl> <dbl>
## 1       1 M       7.9  12.3  10.7
## 2       2 F       6.3  10.6  11.1
## 3       3 F       9.5  13.1  13.8
## 4       4 M      11.5  13.4  12.9
```

Gathering

- Repeated Measures Data
- Variables “0.3”, “0.6”, and “0.8” are Measuring the Same Thing Under Different Drug Strengths
- The Name of the Variable Whose Values Form the Column Names Can Be Called “Dosage”
- The Name of the Variable Whose Values are Spread Over the Cells Can Be Called “Outcome”

Gathering



```
tidy2a=untidy2 %>%
  gather(`0.3`:`0.8`,key="Dosage",value="Outcome")
glimpse(tidy2a)
```

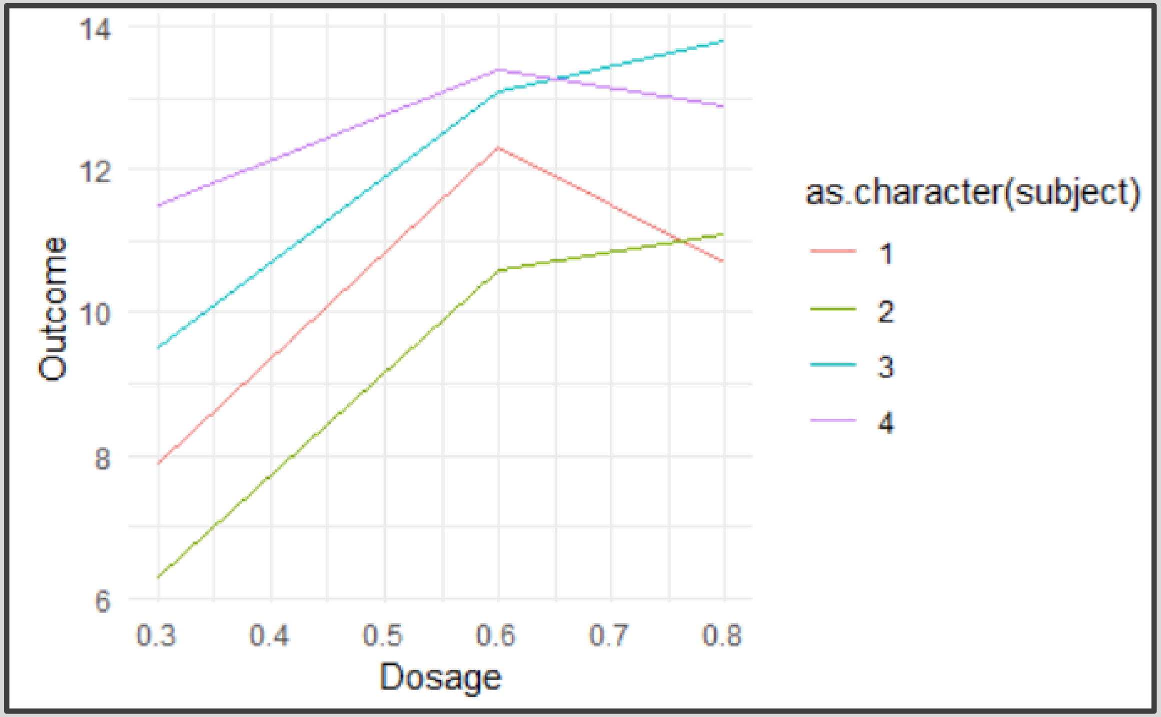
```
## Observations: 12
## Variables: 4
## $ subject <dbl> 1, 2, 3, 4, 1, 2, 3, 4, 1, 2, 3, 4
## $ sex     <chr> "M", "F", "F", "M", "M", "F", "F", "M", "M",
 "F", "F",...
## $ Dosage  <chr> "0.3", "0.3", "0.3", "0.3", "0.6", "0.6", "0
.6", "0.6"...
## $ Outcome <dbl> 7.9, 6.3, 9.5, 11.5, 12.3, 10.6, 13.1, 13.4,
 10.7, 11....
```

```
tidy2b=untidy2 %>%
  gather(`0.3`:`0.8`,key="Dosage",value="Outcome",convert=T)
glimpse(tidy2b)
```

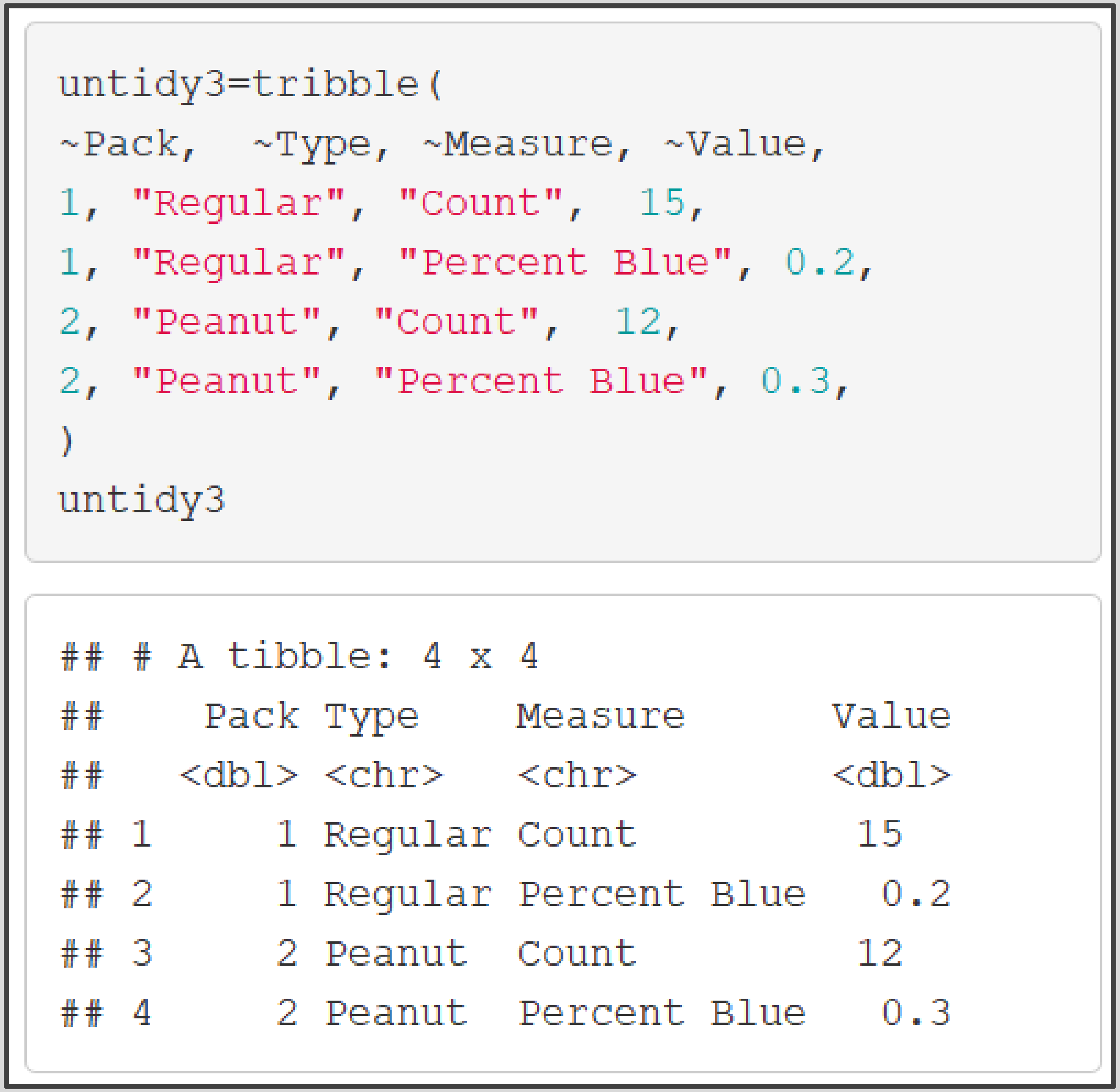
```
## Observations: 12
## Variables: 4
## $ subject <dbl> 1, 2, 3, 4, 1, 2, 3, 4, 1, 2, 3, 4
## $ sex     <chr> "M", "F", "F", "M", "M", "F", "F", "M", "M",
 "F", "F",...
## $ Dosage  <dbl> 0.3, 0.3, 0.3, 0.3, 0.6, 0.6, 0.6, 0.6, 0.8,
 0.8, 0.8,...
## $ Outcome <dbl> 7.9, 6.3, 9.5, 11.5, 12.3, 10.6, 13.1, 13.4,
 10.7, 11....
```

Gathering

- Why Do This Nonsense?



Untidy Data Example 3



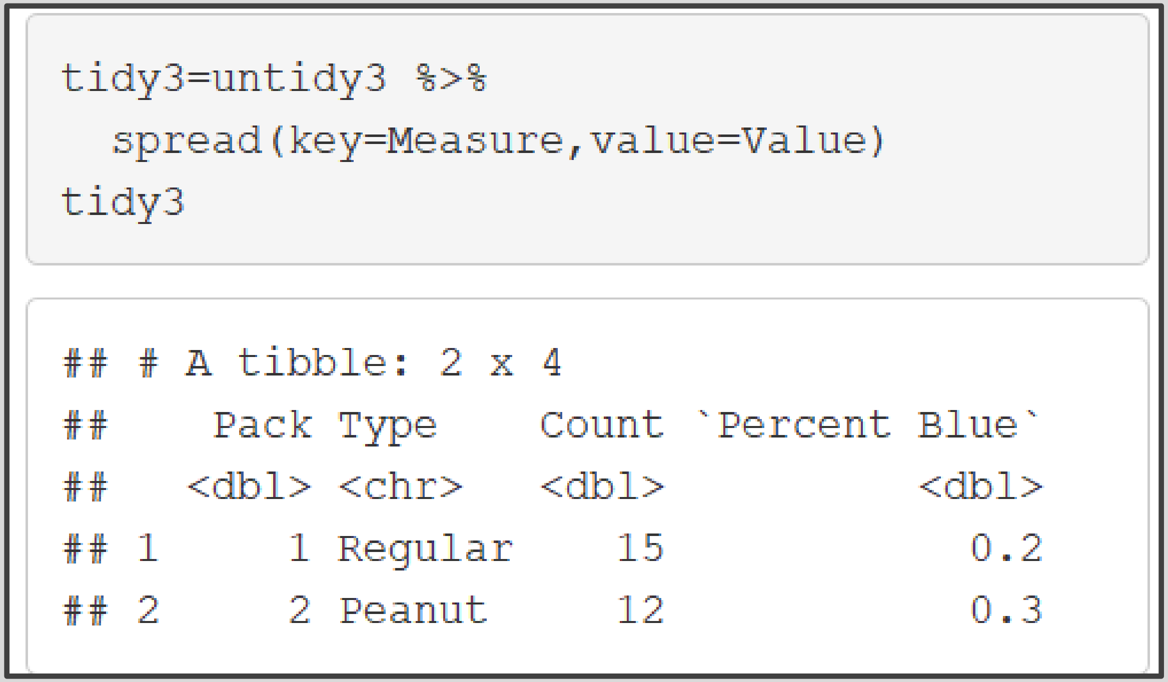
```
untidy3=tribble(
~Pack,  ~Type, ~Measure, ~Value,
1, "Regular", "Count",  15,
1, "Regular", "Percent Blue", 0.2,
2, "Peanut", "Count",  12,
2, "Peanut", "Percent Blue", 0.3,
)
untidy3
```

```
## # A tibble: 4 x 4
##    Pack Type    Measure      Value
##   <dbl> <chr>   <chr>        <dbl>
## 1     1 Regular Count         15  
## 2     1 Regular Percent Blue   0.2
## 3     2 Peanut  Count         12  
## 4     2 Peanut  Percent Blue   0.3
```

Spreading

- Less Common
- Column “Measures” Contains Variable Names
- Column “Value” Contains the Output of the Different Variables
- Notice Values are of Different Units (Count vs Percentage)
- Spreading Does the Opposite of Gathering

Spreading

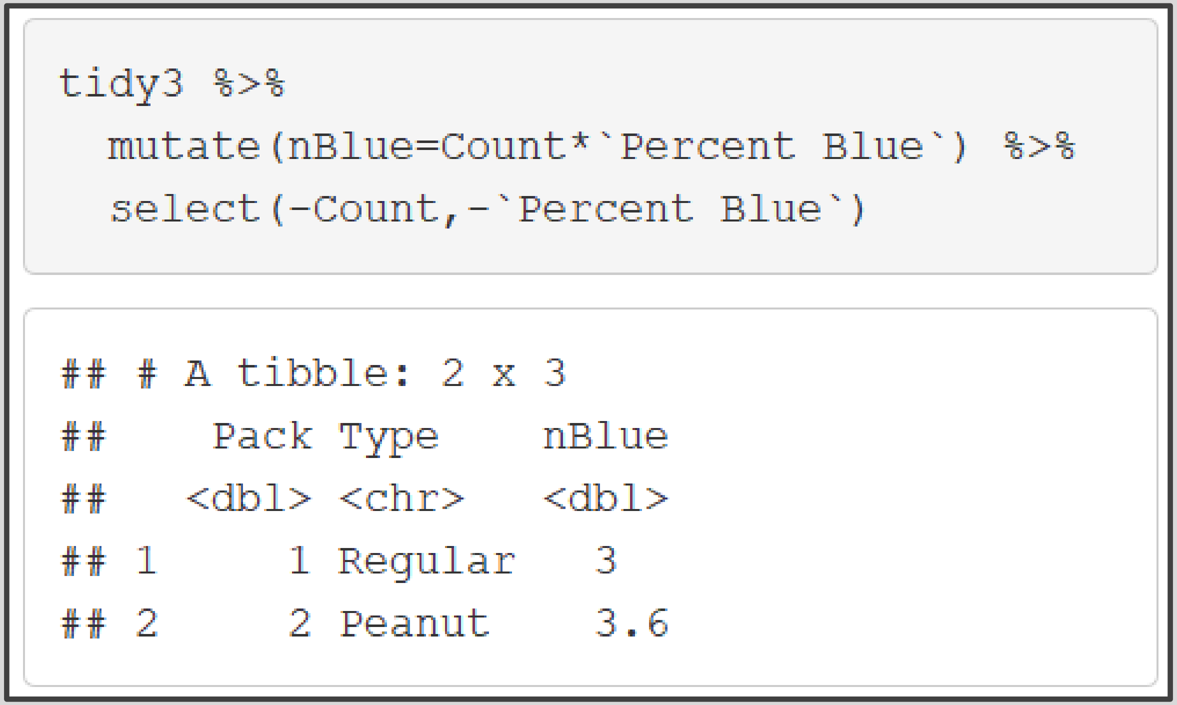


```
tidy3=untidy3 %>%
  spread(key=Measure,value=Value)
tidy3
```

```
## # A tibble: 2 x 4
##    Pack Type    Count `Percent Blue`
##   <dbl> <chr>   <dbl>          <dbl>
## 1     1 Regular    15            0.2
## 2     2 Peanut     12            0.3
```

Spreading

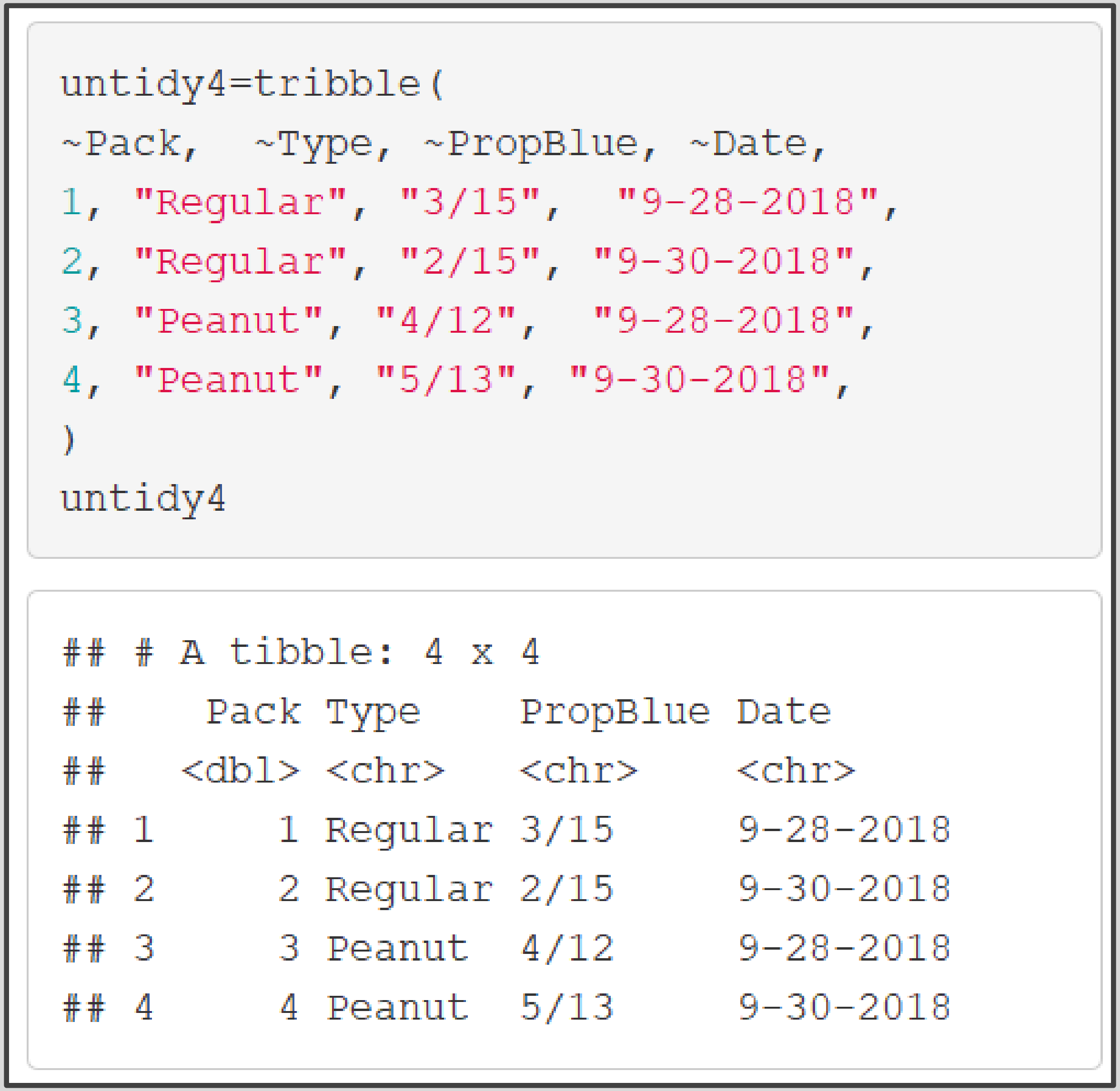
- Why Do This Nonsense?



```
tidy3 %>%
  mutate(nBlue=Count*`Percent Blue`) %>%
  select(-Count,-`Percent Blue`)
```

```
## # A tibble: 2 x 3
##     Pack Type    nBlue
##    <dbl> <chr>   <dbl>
## 1      1 Regular   3
## 2      2 Peanut    3.6
```

Untidy Data Example 4



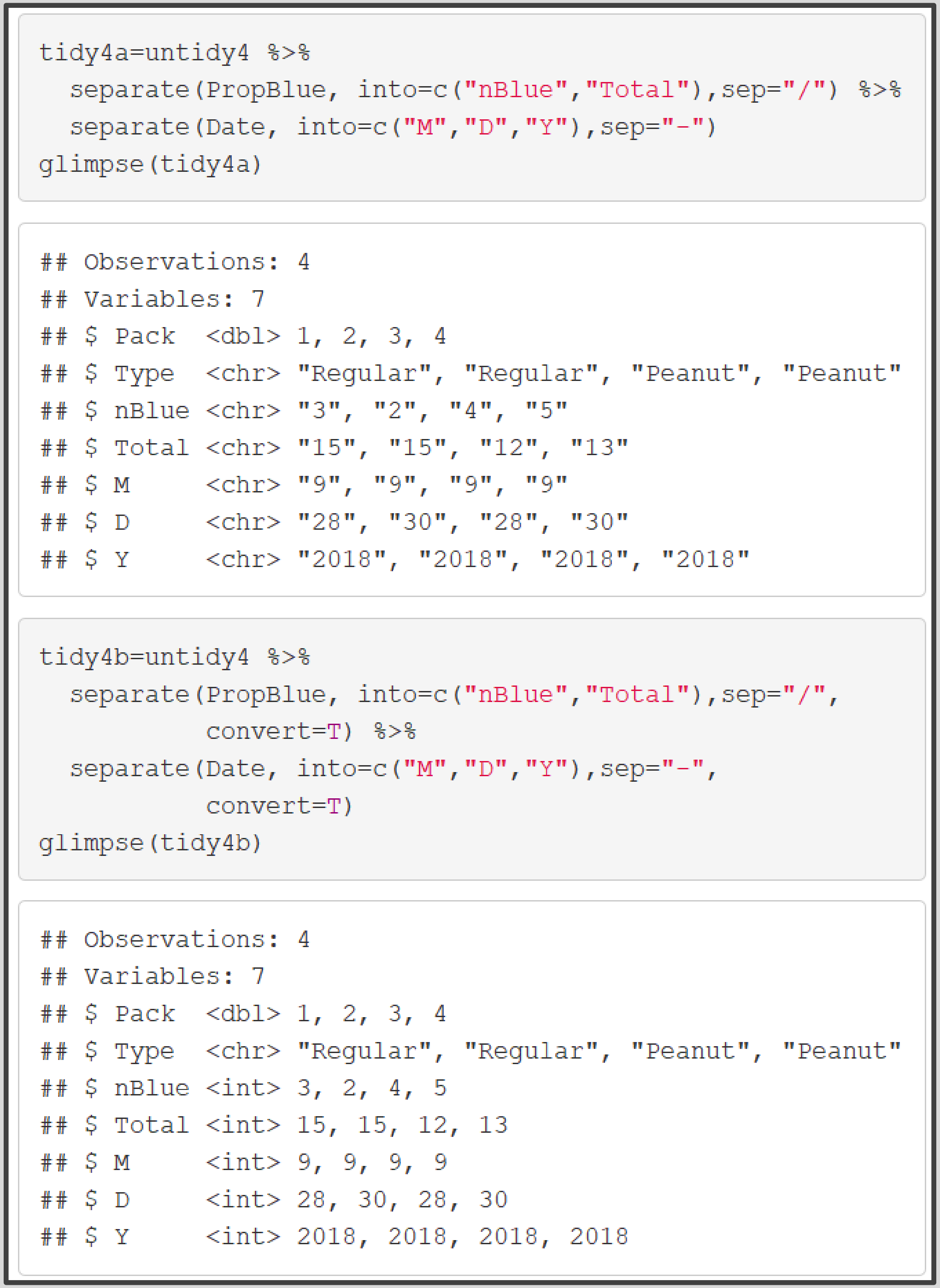
```
untidy4=tribble(
~Pack,  ~Type, ~PropBlue, ~Date,
1, "Regular", "3/15",  "9-28-2018",
2, "Regular", "2/15", "9-30-2018",
3, "Peanut", "4/12",  "9-28-2018",
4, "Peanut", "5/13", "9-30-2018",
)
untidy4
```

```
## # A tibble: 4 x 4
##    Pack Type    PropBlue Date
##   <dbl> <chr>   <chr>    <chr>
## 1     1 Regular 3/15     9-28-2018
## 2     2 Regular 2/15     9-30-2018
## 3     3 Peanut  4/12     9-28-2018
## 4     4 Peanut  5/13     9-30-2018
```

Separating

- Very Uncommon
- The Variable “PropBlue” Contains Two Numeric Variables
- The Variable “Date” Contains Three Numeric Variables
- We Must Separate Both of These Variables Into Multiple Columns

Separating



```
tidy4a=untidy4 %>%
  separate(PropBlue, into=c("nBlue","Total"),sep="/") %>%
  separate(Date, into=c("M","D","Y"),sep="-")
glimpse(tidy4a)
```

```
## Observations: 4
## Variables: 7
## $ Pack  <dbl> 1, 2, 3, 4
## $ Type  <chr> "Regular", "Regular", "Peanut", "Peanut"
## $ nBlue <chr> "3", "2", "4", "5"
## $ Total <chr> "15", "15", "12", "13"
## $ M     <chr> "9", "9", "9", "9"
## $ D     <chr> "28", "30", "28", "30"
## $ Y     <chr> "2018", "2018", "2018", "2018"
```

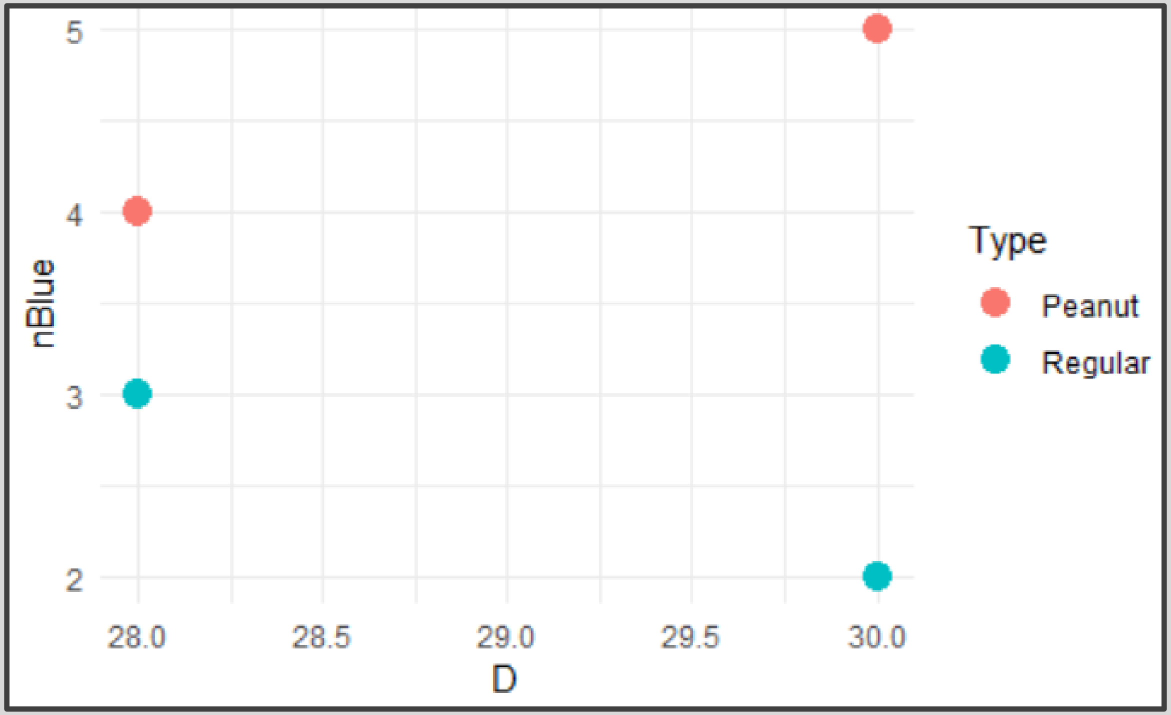
```
tidy4b=untidy4 %>%
  separate(PropBlue, into=c("nBlue","Total"),sep="/",
           convert=T) %>%
  separate(Date, into=c("M","D","Y"),sep="-",
           convert=T)
glimpse(tidy4b)
```

```
## Observations: 4
## Variables: 7
## $ Pack  <dbl> 1, 2, 3, 4
## $ Type  <chr> "Regular", "Regular", "Peanut", "Peanut"
## $ nBlue <int> 3, 2, 4, 5
## $ Total <int> 15, 15, 12, 13
## $ M     <int> 9, 9, 9, 9
## $ D     <int> 28, 30, 28, 30
## $ Y     <int> 2018, 2018, 2018, 2018
```

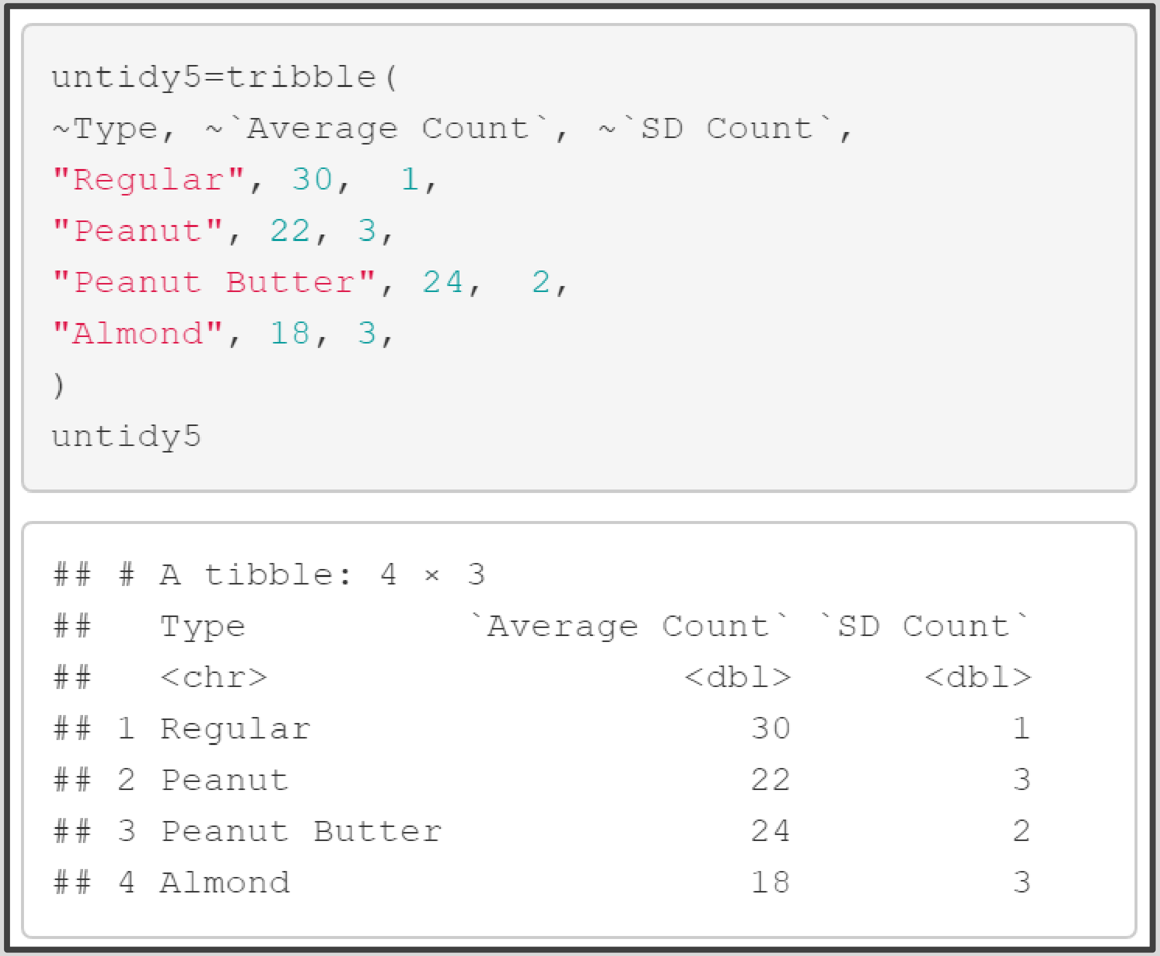
Separating

- Why Do This Nonsense?
  "I have no idea"

- Maybe…



Untidy Data Example 5

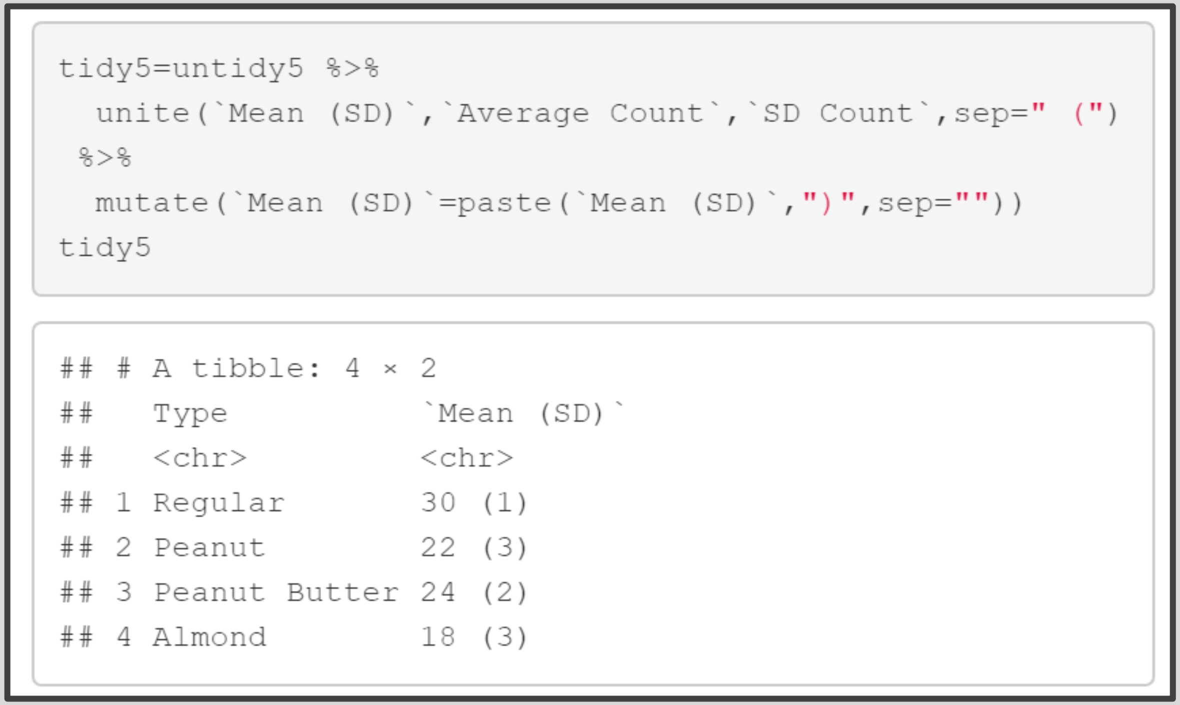


```
untidy5=tribble(
~Type, ~`Average Count`, ~`SD Count`,
"Regular", 30,   1,
"Peanut", 22, 3,
"Peanut Butter", 24,   2,
"Almond", 18, 3,
)
untidy5
```

```
## # A tibble: 4 × 3
##   Type           `Average Count` `SD Count`
##   <chr>                    <dbl>      <dbl>
## 1 Regular                     30          1
## 2 Peanut                      22          3
## 3 Peanut Butter               24          2
## 4 Almond                      18          3
```

Uniting

- Uniting Does the Opposite of Separating
- Combine Information Prior to Presenting in Table



```
tidy5=untidy5 %>%
  unite(`Mean (SD)`,`Average Count`,`SD Count`,sep=" (")
 %>%
  mutate(`Mean (SD)`=paste(`Mean (SD)`,")",sep=""))
tidy5
```

```
## # A tibble: 4 × 2
##   Type           `Mean (SD)`
##   <chr>          <chr>
## 1 Regular        30 (1)
## 2 Peanut         22 (3)
## 3 Peanut Butter  24 (2)
## 4 Almond         18 (3)
```

Closing

Disperse and Make Reasonable Decisions