

From Longer and Wider, We Stand on Guard for Thee

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Packages

```
library(tidyverse)
```

```
## -- Attaching packages -----
```

```
## v ggplot2 3.2.1      v purrr  0.3.2
```

```
## v tibble  2.1.3      v dplyr  0.8.3
```

```
## v tidyr   1.0.0      v stringr 1.4.0
```

```
## v readr   1.3.1      v forcats 0.4.0
```

```
## -- Conflicts -----
```

```
## x dplyr::filter() masks stats::filter()
```

```
## x dplyr::lag()     masks stats::lag()
```

```
library(broom)
```

Pig feed

20 pigs are randomly assigned to one of four pig feeds, and the weight gain of each pig is measured:

pig	feed1	feed2	feed3	feed4
1	60.8	68.7	92.6	87.9
2	57.0	67.7	92.1	84.2
3	65.0	74.0	90.2	83.1
4	58.6	66.3	96.5	85.7
5	61.7	69.8	99.1	90.3

Say we want graphs of weight gain for each feed.

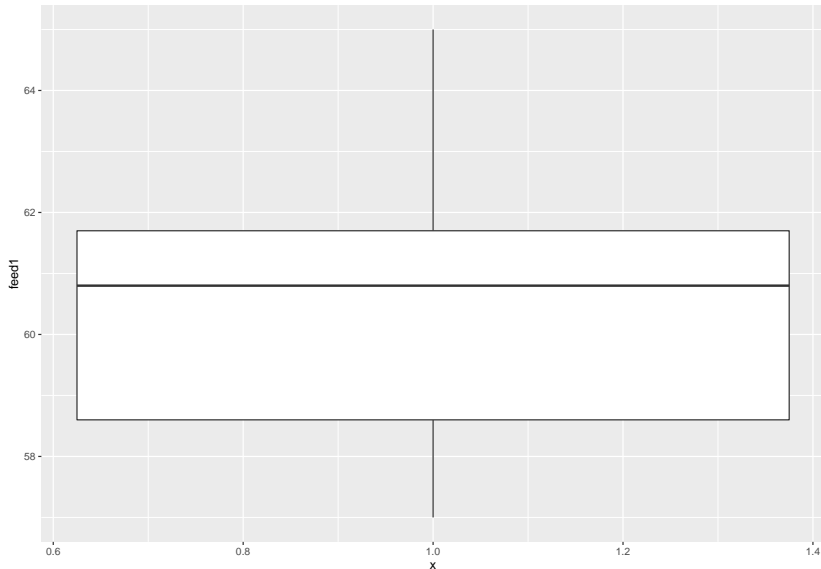
Read in:

```
pigs <- read_table("pigs1.txt")  
pigs
```

```
## # A tibble: 5 x 5  
##   pig feed1 feed2 feed3 feed4  
##   <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1     1  60.8  68.7  92.6  87.9  
## 2     2   57   67.7  92.1  84.2  
## 3     3   65   74   90.2  83.1  
## 4     4  58.6  66.3  96.5  85.7  
## 5     5  61.7  69.8  99.1  90.3
```

and then we have to do this 4 times...

```
ggplot(pigs, aes(x=1, y=feed1)) + geom_boxplot()
```



The problem

- ▶ The data frame is the *wrong shape*.
- ▶ Need all the weight gains in *one* column, with another column saying what feed that weight gain was from
- ▶ Make data frame longer.
- ▶ Old tools:
 - ▶ reshape
 - ▶ reshape2
 - ▶ gather (from tidyr)
- ▶ New tool: `pivot_longer`

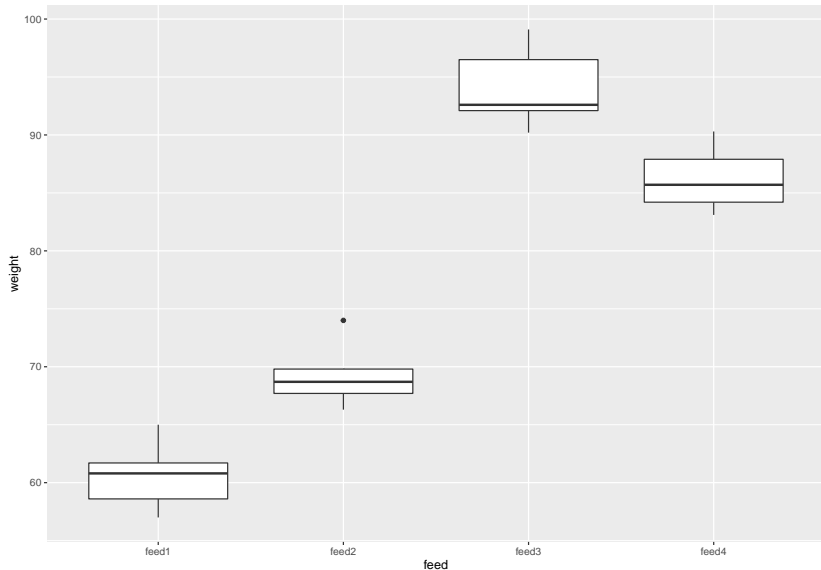
The results

```
pigs_longer
```

```
## # A tibble: 20 x 3
##       pig feed  weight
##   <dbl> <chr>  <dbl>
## 1     1     1 feed1    60.8
## 2     2     1 feed2    68.7
## 3     3     1 feed3    92.6
## 4     4     1 feed4    87.9
## 5     5     2 feed1     57
## 6     6     2 feed2    67.7
## 7     7     2 feed3    92.1
## 8     8     2 feed4    84.2
## 9     9     3 feed1     65
## 10    10     3 feed2     74
## 11    11     3 feed3    90.2
## 12    12     3 feed4    83.1
## 13    13     4 feed1    58.6
## 14    14     4 feed2    66.2
```


Now we can make all 4 graphs at once

```
ggplot(pigs_longer, aes(x=feed, y=weight)) + geom_boxplot()
```



Making wider

`pivot_wider` is inverse of `pivot_longer`:

```
pigs_longer %>%  
  pivot_wider(names_from=feed, values_from=weight)
```

```
## # A tibble: 5 x 5  
##   pig feed1 feed2 feed3 feed4  
##   <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1     1  60.8  68.7  92.6  87.9  
## 2     2   57   67.7  92.1  84.2  
## 3     3   65   74   90.2  83.1  
## 4     4  58.6  66.3  96.5  85.7  
## 5     5  61.7  69.8  99.1  90.3
```

we are back where we started.

Disease presence and absence at two locations

Frequencies of plants observed with and without disease at two locations:

Species	Disease present		Disease absent	
	Location X	Location Y	Location X	Location Y
A	44	12	38	10
B	28	22	20	18

This has two rows of headers, so I rewrote the data file:

Species	present_x	present_y	absent_x	absent_y
A	44	12	38	10
B	28	22	20	18

Read into data frame called `prevalence`.

Gather

needs to take two steps:

```
prevalence %>%  
  gather(disloc, freq, -Species) %>%  
  separate(disloc, into=c("disease", "location"))
```

```
## # A tibble: 8 x 4  
##   Species disease location  freq  
##   <chr>    <chr>   <chr>    <dbl>  
## 1 A      present x         44  
## 2 B      present x         28  
## 3 A      present y         12  
## 4 B      present y         22  
## 5 A      absent x         38  
## 6 B      absent x         20  
## 7 A      absent y         10  
## 8 B      absent y         18
```

Making longer, the new way

Each column name encodes both disease and location, so put both of these in `names_to`:

```
prevalence %>%  
  pivot_longer(-Species, names_to=c("disease", "location"),  
               names_sep="_", values_to="frequency") %>%  
  arrange(Species, location, disease) -> prevalence_longer  
prevalence_longer
```

```
## # A tibble: 8 x 4  
##   Species disease location frequency  
##   <chr>    <chr>    <chr>         <dbl>  
## 1 A      absent  x             38  
## 2 A      present x             44  
## 3 A      absent  y             10  
## 4 A      present y             12  
## 5 B      absent  x             20  
## 6 B      present x             28  
## 7 B      absent  y             18
```

How do I make this wider?

```
prevalence_longer %>%  
  pivot_wider(names_from=c(disease, location), values_from=
```

```
## # A tibble: 2 x 5  
##   Species absent_x present_x absent_y present_y  
##   <chr>      <dbl>      <dbl>      <dbl>      <dbl>  
## 1 A           38         44         10         12  
## 2 B           20         28         18         22
```

Interlude

```
pigs_longer %>%  
  group_by(feed) %>%  
  summarize(weight_mean=mean(weight))
```

```
## # A tibble: 4 x 2  
##   feed weight_mean  
##   <chr>         <dbl>  
## 1 feed1         60.6  
## 2 feed2         69.3  
## 3 feed3         94.1  
## 4 feed4         86.2
```

What if summary is more than one number, eg. quartiles?

```
pigs_longer %>%  
  group_by(feed) %>%  
  summarize(r=quantile(weight, c(0.25, 0.75)))
```

```
## Error: Column `r` must be length 1 (a summary value), not length 2
```

the right way to do it

```
pigs_longer %>%  
  group_by(feed) %>%  
  summarize(r=list(quantile(weight, c(0.25, 0.75)))) %>%  
  unnest(r)
```

```
## # A tibble: 8 x 2  
##   feed      r  
##   <chr> <dbl>  
## 1 feed1  58.6  
## 2 feed1  61.7  
## 3 feed2  67.7  
## 4 feed2  69.8  
## 5 feed3  92.1  
## 6 feed3  96.5  
## 7 feed4  84.2  
## 8 feed4  87.9
```


or even better, use tidy from broom:

```
tidy(quantile(pigs_longer$weight, c(0.25, 0.75)))
```

```
## Warning: 'tidy.numeric' is deprecated.
```

```
## See help("Deprecated")
```

```
## # A tibble: 2 x 2
```

```
##   names      x
```

```
##   <chr> <dbl>
```

```
## 1 25%    66.0
```

```
## 2 75%    90.2
```

and so

```
pigs_longer %>%
```

```
  group_by(feed) %>%
```

```
  summarize(r=list(tidy(quantile(weight, c(0.25, 0.75)))))
```

```
  unnest(r) %>%
```

```
  pivot_wider(names_from=names, values_from=x)
```

```
## Warning: 'tidy.numeric' is deprecated.
```

A hairy one

18 people receive one of three treatments. At 3 different times (pre, post, followup) two variables y and z are measured on each person:

```
## # A tibble: 18 x 8
```

##	id	treatment	pre_y	post_y	fu_y	pre_z	post_z
##	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
##	1 A.1	A	3	13	9	0	0
##	2 A.2	A	0	14	10	6	6
##	3 A.3	A	4	6	17	8	2
##	4 A.4	A	7	7	13	7	6
##	5 A.5	A	3	12	11	6	12
##	6 A.6	A	10	14	8	13	3
##	7 B.1	B	9	11	17	8	11
##	8 B.2	B	4	16	13	9	3
##	9 B.3	B	8	10	9	12	0
##	10 B.4	B	5	9	13	3	0
##	11 B.5	B	0	15	11	3	0
##	12 B.6	B	4	11	14	4	2
##	13 Control	1 Control	10	12	15	4	3

Attempt 1

```
repmes %>% pivot_longer(contains("_"),  
                        names_to=c("time", "var"),  
                        names_sep="_"  
                        )
```

```
## # A tibble: 108 x 5
```

```
##   id      treatment time  var  value  
##   <chr> <chr>      <chr> <chr> <dbl>  
## 1 A.1    A          pre   y      3  
## 2 A.1    A          post  y     13  
## 3 A.1    A          fu    y      9  
## 4 A.1    A          pre   z      0  
## 5 A.1    A          post  z      0  
## 6 A.1    A          fu    z      9  
## 7 A.2    A          pre   y      0  
## 8 A.2    A          post  y     14  
## 9 A.2    A          fu    y     10  
## 10 A.2   A          pre   z      6
```

```
## # with 98 more rows
```

Attempt 2

```
repmes %>% pivot_longer(contains("_"),  
                        names_to=c("time", ".value"),  
                        names_sep="_"  
                        ) -> repmes3
```

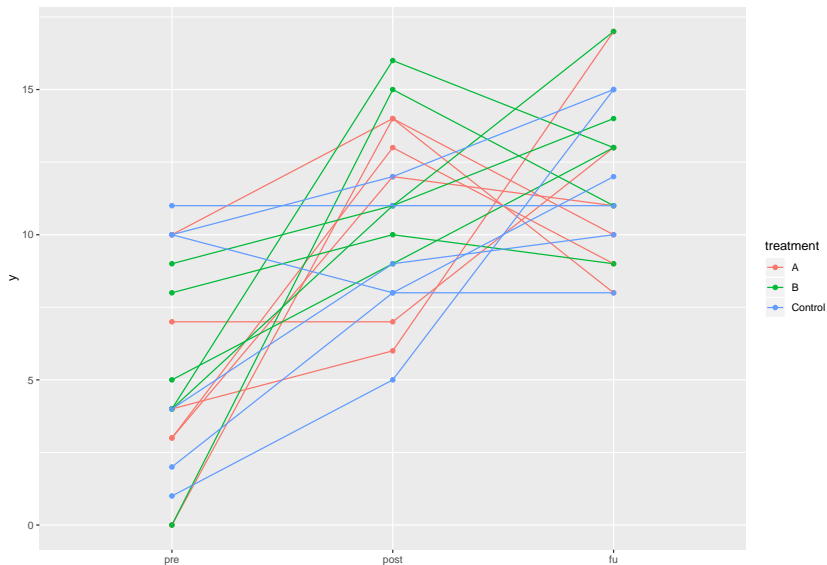
repmes3

A tibble: 54 x 5

##	id	treatment	time	y	z
##	<chr>	<chr>	<chr>	<dbl>	<dbl>
##	1 A.1	A	pre	3	0
##	2 A.1	A	post	13	0
##	3 A.1	A	fu	9	9
##	4 A.2	A	pre	0	6
##	5 A.2	A	post	14	6
##	6 A.2	A	fu	10	3
##	7 A.3	A	pre	4	8
##	8 A.3	A	post	6	2
##	9 A.3	A	fu	17	6
##	10 A.4	A	pre	7	7

make a graph

```
ggplot(repmes3, aes(x=fct_inorder(time), y=y, colour=treatment)) +  
  geom_point() + geom_line()
```



thank you!