

R Notebook

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Load libraries

```
library(tidyverse)
```

```
## -- Attaching packages -----
## v ggplot2 3.3.0      v purrr  0.3.3
## v tibble  3.0.0      v dplyr  0.8.5
## v tidyr   1.0.2      v stringr 1.4.0
## v readr   1.3.1      v forcats 0.5.0

## Warning: package 'ggplot2' was built under R version 3.6.3
## Warning: package 'tibble' was built under R version 3.6.3
## Warning: package 'tidyr' was built under R version 3.6.3
## Warning: package 'dplyr' was built under R version 3.6.3
## Warning: package 'forcats' was built under R version 3.6.3

## -- Conflicts -----
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()
```

```
library(ez)
```

```
## Registered S3 methods overwritten by 'lme4':
##   method                                from
##   cooks.distance.influence.merMod      car
##   influence.merMod                     car
##   dfbeta.influence.merMod              car
##   dfbetas.influence.merMod            car
```

```
library(psych)
```

```
##
## Attaching package: 'psych'

## The following objects are masked from 'package:ggplot2':
##
##   %+%, alpha
```

Class example

Read in data

```
syl <- read_csv("syllables.csv")
```

```
## Parsed with column specification:
## cols(
##   ID = col_double(),
##   length = col_double(),
##   cond = col_double(),
##   time = col_double()
## )
```

Factor variables

```
syl <- mutate(syl,
              ID    = factor(ID),
              cond   = factor(cond),
              length = factor(length)
              )
```

Repeated measures ANOVA

```
ezANOVA(
  data=syl,
  dv=time,
  wid=ID,
  within= length,
  detailed=TRUE,
  type = 3
)
```

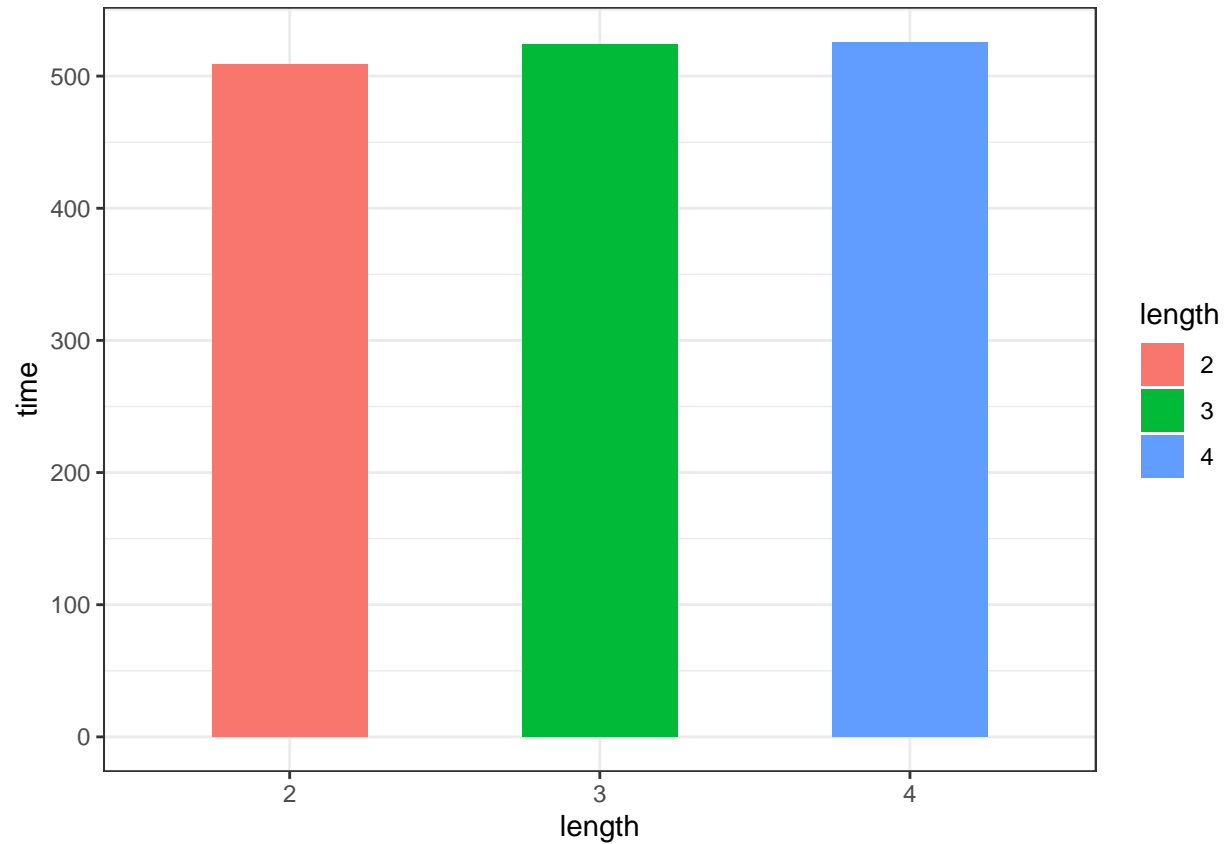
```
## $ANOVA
##      Effect DFn DFd      SSn      SSd      F      p p<.05
## 1 (Intercept)   1  15 12962565.333 133137.333 1460.43544 2.303569e-16 *
## 2      length   2  30   2688.167   3901.167   10.33601 3.848535e-04 *
##      ges
## 1 0.98953873
## 2 0.01923875
##
## $`Mauchly's Test for Sphericity`
##      Effect      W      p p<.05
## 2 length 0.8402584 0.2957264
##
## $`Sphericity Corrections`
##      Effect      GGe      p[GG] p[GG]<.05      HFe      p[HF] p[HF]<.05
## 2 length 0.8622611 0.0008066227 * 0.9638958 0.0004670399 *
```

Visualize the effect

```
syl_sum <- group_by(syl, length)
syl_sum <- summarise(syl_sum, time = mean(time))
syl_sum <- ungroup(syl_sum)

ggplot(syl_sum, aes(x = length, y = time, group = length, fill = length)) +
```

```
geom_col(width = .5) +  
theme_bw()
```



Mixed design

```
ezANOVA(  
  data=syl,  
  dv=time,  
  wid=ID,  
  within= length,  
  between = cond,  
  detailed=TRUE,  
  type = 3  
)
```

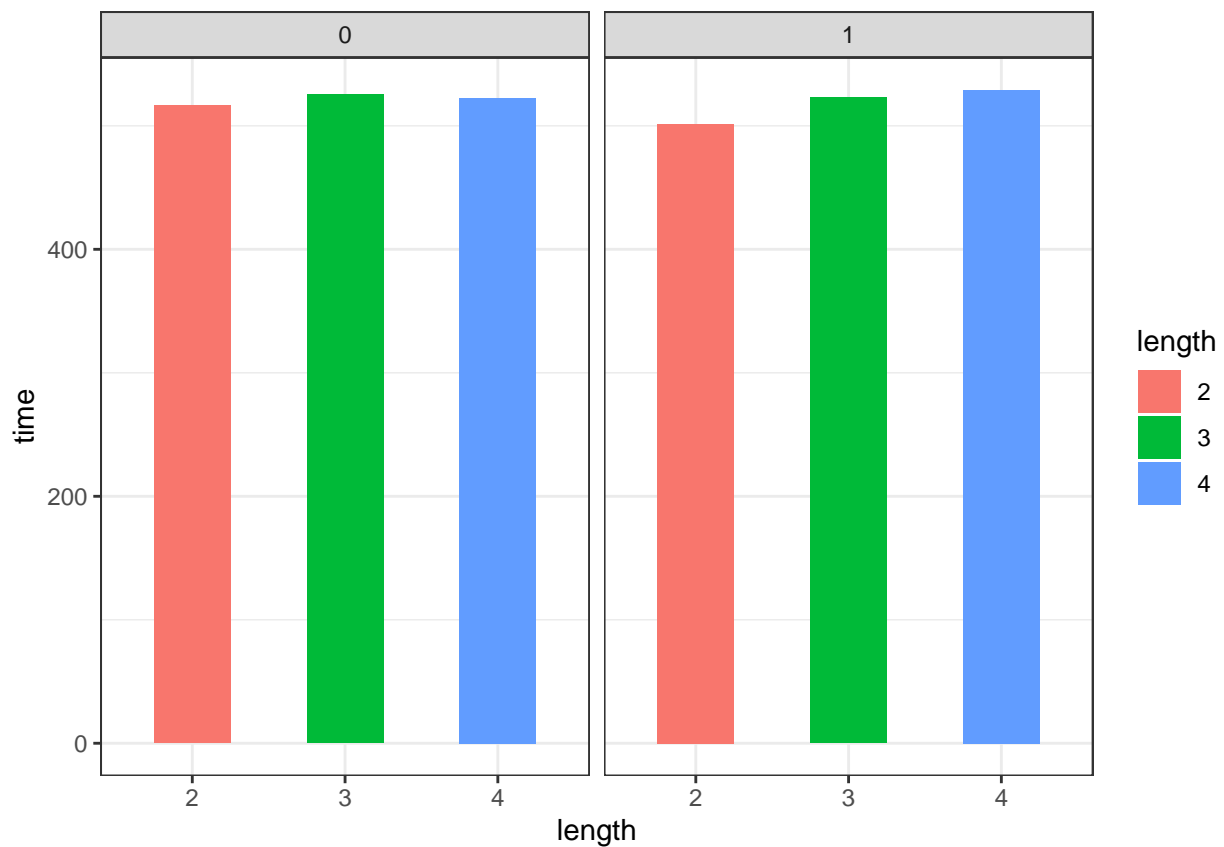
```
## $ANOVA  
##      Effect DFn DFd      SSn      SSd      F      p p<.05  
## 1 (Intercept) 1 14 1.296257e+07 132976 1.364727e+03 2.342147e-15 *  
## 2      cond 1 14 1.613333e+02 132976 1.698552e-02 8.981607e-01  
## 3      length 2 28 2.688167e+03 2986 1.260359e+01 1.249189e-04 *  
## 4 cond:length 2 28 9.151667e+02 2986 4.290802e+00 2.368832e-02 *  
##      ges  
## 1 0.989620054  
## 2 0.001185200  
## 3 0.019388124  
## 4 0.006686043
```

```
##
## $`Mauchly's Test for Sphericity`
##      Effect      W      p p<.05
## 3      length 0.8953253 0.4873887
## 4 cond:length 0.8953253 0.4873887
##
## $`Sphericity Corrections`
##      Effect      GGe      p[GG] p[GG]<.05      HFe      p[HF] p[HF]<.05
## 3      length 0.9052438 0.000229641      * 1.031925 0.0001249189      *
## 4 cond:length 0.9052438 0.027987781      * 1.031925 0.0236883156      *
```

Visualize the effect

```
syl_sum <- group_by(syl, cond, length)
syl_sum <- summarise(syl_sum, time = mean(time))
syl_sum <- ungroup(syl_sum)

ggplot(syl_sum, aes(x = length, y = time, group = length, fill = length)) +
  geom_col(width = .5) +
  facet_wrap(~cond) +
  theme_bw()
```



Assignment

Load data

```
ex <- read_csv("RMexample.csv")

## Parsed with column specification:
## cols(
##   Y = col_double(),
##   Subject = col_double(),
##   Passage = col_character(),
##   Author = col_character(),
##   Genre = col_character()
## )
```

Describe data

```
describe(ex)
```

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis
## Y	1	90	9.37	5.01	9.0	8.88	4.45	2	22	20	0.8	-0.08
## Subject	2	90	15.50	8.70	15.5	15.50	11.12	1	30	29	0.0	-1.24
## Passage*	3	90	NaN	NA	NA	NaN	NA	Inf	-Inf	-Inf	NA	NA
## Author*	4	90	NaN	NA	NA	NaN	NA	Inf	-Inf	-Inf	NA	NA
## Genre*	5	90	NaN	NA	NA	NaN	NA	Inf	-Inf	-Inf	NA	NA
##	se											
## Y	0.53											
## Subject	0.92											
## Passage*	NA											
## Author*	NA											
## Genre*	NA											

Factor variables

```
ex <- mutate(ex,
  Subject = factor(Subject),
  Passage = factor(Passage),
  Author = factor(Author),
  Genre = factor(Genre)
)
```

Run ANOVA

Within subject effect

```
ezANOVA(
  data=ex,
  dv=Y,
  wid=Subject,
  within= Passage,
  detailed=TRUE,
  type = 3
)
```

```
## $ANOVA
##      Effect DFn DFd      SSn      SSd      F      p p<.05      ges
## 1 (Intercept)   1  29 7896.1 1430.9 160.02998 2.487330e-13 * 0.8303643
## 2      Passage   2  58  621.8  182.2  98.96926 2.011302e-19 * 0.2782227
##
## $`Mauchly's Test for Sphericity`
##      Effect      W      p p<.05
## 2 Passage 0.2096585 3.170844e-10 *
##
## $`Sphericity Corrections`
##      Effect      GGe      p[GG] p[GG]<.05      HFe      p[HF] p[HF]<.05
## 2 Passage 0.5585527 7.307395e-12 * 0.5650984 5.64017e-12 *
```

Eta Squareds

Mixed ANOVA

```
ezANOVA(
  data=ex,
  dv=Y,
  wid=Subject,
  within= Passage,
  between = .(Author, Genre),
  detailed=TRUE,
  type = 3
)
```

```
## $ANOVA
##      Effect DFn DFd      SSn      SSd      F      p
## 1      (Intercept)   1  26 7847.524008 1172.9107 173.95665477 5.020221e-13
## 2      Author       1  26  119.787500 1172.9107   2.65533852 1.152603e-01
## 3      Genre        1  26  119.787500 1172.9107   2.65533852 1.152603e-01
## 5      Passage      2  52  615.698016  146.1786 109.51091023 2.280217e-19
## 4 Author:Genre      1  26   1.301786 1172.9107   0.02885678 8.664250e-01
## 6 Author:Passage    2  52   14.167857  146.1786   2.51996091 9.024746e-02
## 7 Genre:Passage     2  52   18.301190  146.1786   3.25513478 4.656422e-02
## 8 Author:Genre:Passage 2  52   1.253571  146.1786   0.22296604 8.009030e-01
##      p<.05      ges
## 1 * 0.8560985128
## 2 0.0832507003
## 3 0.0832507003
## 5 * 0.3182251689
## 4 0.0009859092
## 6 0.0106265001
## 7 * 0.0136842536
## 8 0.0009494287
##
## $`Mauchly's Test for Sphericity`
##      Effect      W      p p<.05
## 5      Passage 0.2474489 2.621612e-08 *
## 6 Author:Passage 0.2474489 2.621612e-08 *
## 7 Genre:Passage 0.2474489 2.621612e-08 *
## 8 Author:Genre:Passage 0.2474489 2.621612e-08 *
```

```
## $`Sphericity Corrections`
##           Effect      GGe      p[GG] p[GG]<.05      HFe      p[HF]
## 5           Passage 0.5705968 5.012241e-12      * 0.5795175 3.523916e-12
## 6   Author:Passage 0.5705968 1.195583e-01      0.5795175 1.189223e-01
## 7     Genre:Passage 0.5705968 7.657504e-02      0.5795175 7.581097e-02
## 8 Author:Genre:Passage 0.5705968 6.723728e-01      0.5795175 6.760755e-01
##   p[HF]<.05
## 5           *
## 6
## 7
## 8
```

```
ex_sum <- group_by(ex, Author, Genre, Passage)
ex_sum <- summarise(ex_sum, Y = mean(Y))
ex_sum <- ungroup(ex_sum)
```

```
ggplot(ex_sum, aes(x = Passage, y = Y, group = Passage, fill = Passage)) +
  geom_col(width = .5) +
  facet_wrap(~ Author + Genre) +
  theme_bw()
```

