

Repeated Measures (RM-ANOVA) Adding a Predictor

Andrew Zieffler

Educational Psychology

UNIVERSITY OF MINNESOTA

Driven to DiscoverSM

Read in the minneapolis.csv data

```
## Read in the data  
> mpls = read.csv("http://www.tc.umn.edu/~zief0002/Data/minneapolis.csv")
```

Packages Needed

- ez
- ggplot2
- reshape2

```
> mpls2 = mpls[complete.cases(mpls), ]
```

Remove rows with
missing data

Reshape Wide to Long Data

```
## Use the reshape2 package
> library(reshape2)

## Melt the data to the long format
> mplsLong = melt(
  mpls2,
  id = c("studentID", "female"),
  measure = c("grade.5", "grade.6", "grade.7", "grade.8")
)
```

The id= argument

keep these
variables as
columns

The measure= argument

Change these variables into
two new ones...variable
and value

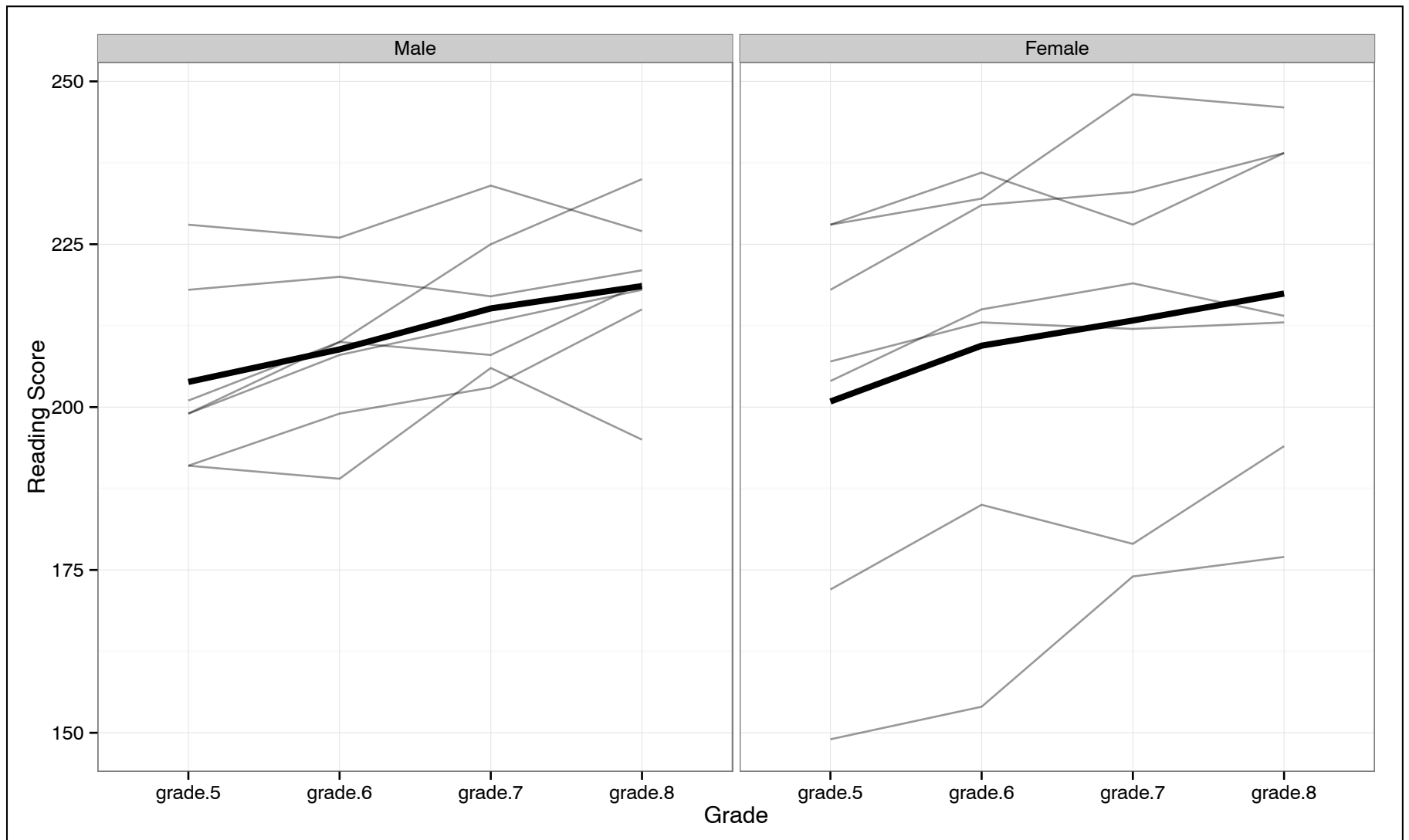
```
> head(mplsLong)
```

	studentID	female	variable	value
1	1	1	read.5	172
2	3	0	read.5	191
3	5	1	read.5	207
4	6	0	read.5	191
5	7	0	read.5	199
6	9	1	read.5	149

- Change the column names from “variable” and “value” (to “grade” and “read”)
- Change the level names of the new “grade” column
- Coerce “female” into a factor
- Coerce “studentID” into a factor

```
> head(mplsLong)
```

	studentID	female	grade	read	student
1	1	Female	grade.5	172	1
2	3	Male	grade.5	191	3
3	5	Female	grade.5	207	5
4	6	Male	grade.5	191	6
5	7	Male	grade.5	199	7
6	9	Female	grade.5	149	9



- The plot shows differences in reading score over grade (for both males and females)
- The plot shows differences in reading scores between males and females (at each grade)


USING THE EZANOVA FUNCTION

Fit the Mixed-Effects ANOVA using ezANOVA()

```
## Load the ez library
> library(ez)

## Fit the model
> rm.aov = ezANOVA(data = mplsLong,
  dv = read,
  wid = student,
  within = .(grade),
  between = .(female),
  detailed = TRUE
)

> rm.aov
```



Add a between-subjects factor

Since the data are repeated measures, sphericity is assumed to be untenable, regardless of Mauchly's test. (Ignore this output!)

```
$`Sphericity Corrections`  
      Effect      GGe      p[GG] p[GG]<.05      HFe      p[HF] p[HF]<.05  
3      grade 0.6613116 2.262608e-05      * 0.7917665 4.628061e-06      *  
4 female:grade 0.6613116 8.081902e-01      0.7917665 8.445250e-01
```

- The analysis suggests there is no sex by grade interaction ($p = 0.808$). Females and males do not have differing mean patterns in reading scores (at least in 5th–8th grade in this population).

Now we can examine the main-effect of female and the main-effect for grade.

\$ANOVA										
	Effect	DFn	DFd	SSn	SSd	F	p	p<.05	ges	
1	(Intercept)	1	12	2.491488e+06	21670.429	1.379662e+03	9.306976e-14	*	0.990854586	
2	female	1	12	2.578571e+01	21670.429	1.427884e-02	9.068611e-01		0.001120057	
3	grade	3	36	1.924429e+03	1325.571	1.742127e+01	3.734349e-07	*	0.077222932	
4	female:grade	3	36	2.350000e+01	1325.571	2.127384e-01	8.869166e-01		0.001020874	
\$`Mauchly's Test for Sphericity`										
	Effect	W	p p<.05							
3	grade	0.205963	0.004795956	*						
4	female:grade	0.205963	0.004795956	*						
\$`Sphericity Corrections`										
	Effect	GGe	p[GG]	p[GG]<.05	HFe	p[HF]	p[HF]<.05			
3	grade	0.6613116	2.262608e-05	*	0.7917665	4.628061e-06	*			
4	female:grade	0.6613116	8.081902e-01		0.7917665	8.445250e-01				

- The analysis suggests there is an effect of grade ($p < .001$), controlling for sex. There is *at least* one mean reading scores (in 5th–8th grade in this population) that is different from the others.
- The analysis suggests there is not an effect of female ($p = .907$), controlling for grade. There is no difference in the mean reading scores between males and females at any grade level.