

## Section 7.1 Interaction

Loaded needed packages.

```
library(Stat2Data)
library(mosaic)
```

EXAMPLE 7.2 Birds and hormones, Pigs and vitamins

(a) Birds and hormones

Create a dataframe for **BirdCalcium** and look at the structure of the data.

```
data("BirdCalcium")
str(BirdCalcium)

## 'data.frame': 20 obs. of 5 variables:
## $ Bird : int 1 2 3 4 5 6 7 8 9 10 ...
## $ Sex : Factor w/ 2 levels "female","male": 2 2 2 2 2 2 2 2 2 2 ...
## $ Hormone: Factor w/ 2 levels "no","yes": 1 1 1 1 1 2 2 2 2 2 ...
## $ Group : Factor w/ 4 levels "F No","F Yes",...: 3 3 3 3 3 4 4 4 4 4 ...
## $ Ca : num 14.5 11 10.8 14.3 10 32 23.8 28.8 25 29.3 ...
```

TABLE 7.1 Birds and blood calcium

```
unstack(BirdCalcium,Ca~Group)

## F.No F.Yes M.No M.Yes
## 1 16.5 31.9 14.5 32.0
## 2 18.4 26.2 11.0 23.8
## 3 12.7 21.3 10.8 28.8
## 4 14.0 35.8 14.3 25.0
## 5 12.8 40.2 10.0 29.3
```

(b) Pigs and vitamins

Create a dataframe for **PigFeed** and look at the structure of the data.

```
data("PigFeed")
str(PigFeed)

## 'data.frame': 12 obs. of 3 variables:
## $ WgtGain : int 30 8 19 5 0 4 26 21 19 52 ...
## $ Antibiotic: Factor w/ 2 levels "No","Yes": 1 1 1 2 2 2 1 1 1 2 ...
## $ B12 : Factor w/ 2 levels "No","Yes": 1 1 1 1 1 1 2 2 2 2 ...
```

TABLE 7.2 Weekly weight gain, in hundredths of a pound above 1 pound

```
unstack(PigFeed,WgtGain~Antibiotic:B12)
```

```
##   No.No No.Yes Yes.No Yes.Yes
## 1    30    26     5    52
## 2     8    21     0    56
## 3    19    19     4    54
```

For the table above, the key is Antibiotic.B12 for each header. Note that you can easily reverse the order by changing the option in the unstack command to unstack(PigFeed, WgtGain~B12:Antibiotic).

EXAMPLE 7.4 Birds and pigs: Interaction as a numeric difference of differences

(a) Birds: no interaction

Compute cell means and differences.

```
Birdcellmeans=mean(Ca~Hormone:Sex,data=BirdCalcium)
Birdcellmeans
```

```
## no:female no:male yes:female yes:male
##    14.88    12.12    31.08    27.78
```

```
MaleDiff=as.numeric(Birdcellmeans[4]-Birdcellmeans[2])
FemaleDiff=as.numeric(Birdcellmeans[3]-Birdcellmeans[1])
NoDiff=as.numeric(Birdcellmeans[1]-Birdcellmeans[2])
YesDiff=as.numeric(Birdcellmeans[3]-Birdcellmeans[4])
c(NoDiff,YesDiff)
```

```
## [1] 2.76 3.30
```

```
c(MaleDiff,FemaleDiff)
```

```
## [1] 15.66 16.20
```

Alternative format for Figure 7.1 in Example 7.4

Combine the cell means and differences into one table.

```
BirdDiffs=data.frame(NoHormone=c(Birdcellmeans[2:1],NoDiff),
                     YesHormone=c(Birdcellmeans[4:3],YesDiff),
                     Diff=c(MaleDiff,FemaleDiff," "))
rownames(BirdDiffs)=c("Male","Female","Diff")
BirdDiffs
```

```
##      NoHormone YesHormone Diff
## Male      12.12      27.78 15.66
## Female     14.88      31.08 16.2
## Diff       2.76       3.30
```

(b) Pigs: Interaction present

Cell means and differences

```
Pigcellmeans=mean(WgtGain~Antibiotic:B12,data=PigFeed)
Pigcellmeans
```

```
##   No:No  No:Yes  Yes:No  Yes:Yes
##      19      22       3      54
```

```
B12NoDiff=as.numeric(Pigcellmeans[3]-Pigcellmeans[1])
B12YesDiff=as.numeric(Pigcellmeans[4]-Pigcellmeans[2])
AntiNoDiff=as.numeric(Pigcellmeans[2]-Pigcellmeans[1])
AntiYesDiff=as.numeric(Pigcellmeans[4]-Pigcellmeans[3])
c(AntiNoDiff,AntiYesDiff)
```

```
## [1]  3 51
```

```
c(B12NoDiff,B12YesDiff)
```

```
## [1] -16 32
```

Alternative format for Figure 7.2 in Example 7.4

Combine the cell means and differences into one table

```
PigDiffs=data.frame(AntibioticsNo=c(Pigcellmeans[1:2],AntiNoDiff),
                    Antibiotics5=c(Pigcellmeans[3:4],AntiYesDiff),
                    Diff=c(B12NoDiff,B12YesDiff, " "))
rownames(PigDiffs)=c("B12No","B12Yes","Diff")
PigDiffs
```

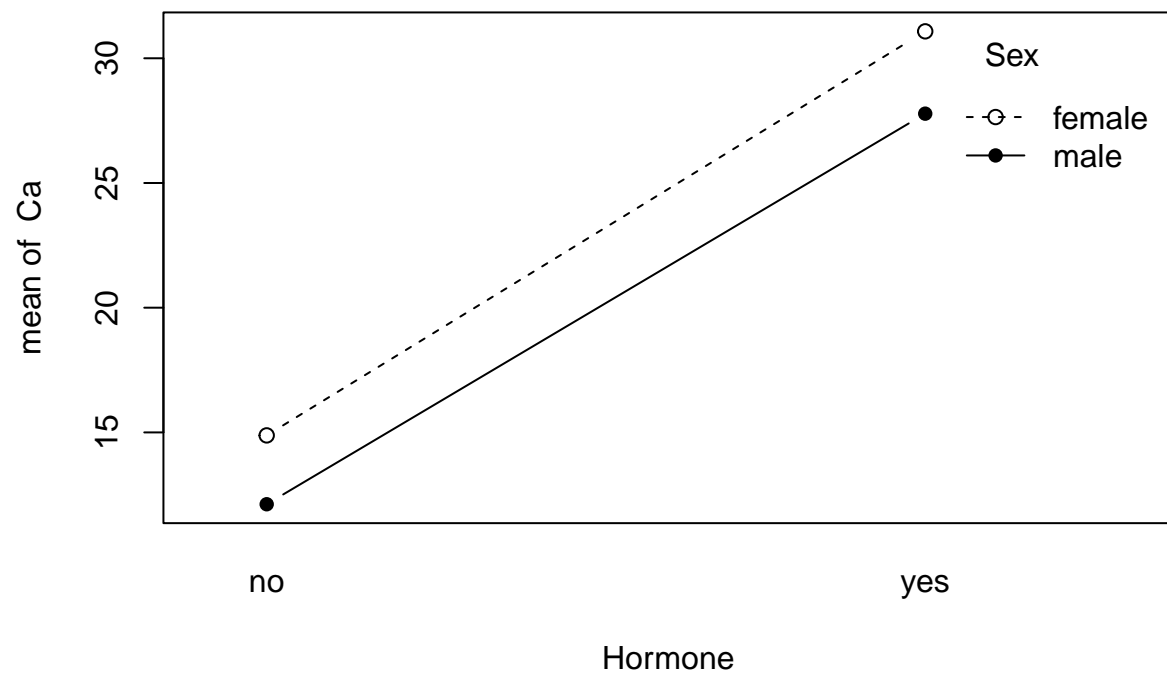
```
##      AntibioticsNo Antibiotics5 Diff
## B12No           19           3  -16
## B12Yes           22          54   32
## Diff             3           51
```

EXAMPLE 7.5 Birds and pigs: Interaction plots

(a) Birds: Interaction plot

Note: The with( ) function saves having to refer to each variable as BirdCalcium\$Hormone, etc.

```
with(BirdCalcium,interaction.plot(Hormone,Sex,Ca,type="b",pch=c(1,16)))
```



(b) Pigs: Interaction plot

```
with(PigFeed,interaction.plot(Antibiotic,B12,WgtGain,type="b",pch=c(1,16)))
```

