

Linear Model Foundations

R Handout

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Initialization

```
> library(NCStats)
```

Background

Sholl *et al.* (2000){:target="_blank"} examined the relative sense of direction for female and male subjects. Specifically, 30 male and 30 female subjects were taken to an unfamiliar wooded park and given spatial orientation tests, including being asked to point to the south. The absolute pointing error (in degrees away from due south) was recorded. The results are in `SexDirection.csv`. Use these results to test, at the 5% level, if males have a better sense of direction than females?

```
> setwd("C:/aaaWork/Web/GitHub/NCMTH207/modules/LMFoundations")
> sdir <- read.csv("SexDirection.csv")
> str(sdir)
```

```
'data.frame':  60 obs. of  2 variables:
 $ abserr: int  13 13 38 59 58 8 130 68 23 5 ...
 $ sex    : Factor w/ 2 levels "female","male": 2 2 2 2 2 2 2 2 2 2 ...
```

```
> sdir$fsex <- factor(sdir$sex,levels=c("male","female"))
> levels(sdir$fsex)
```

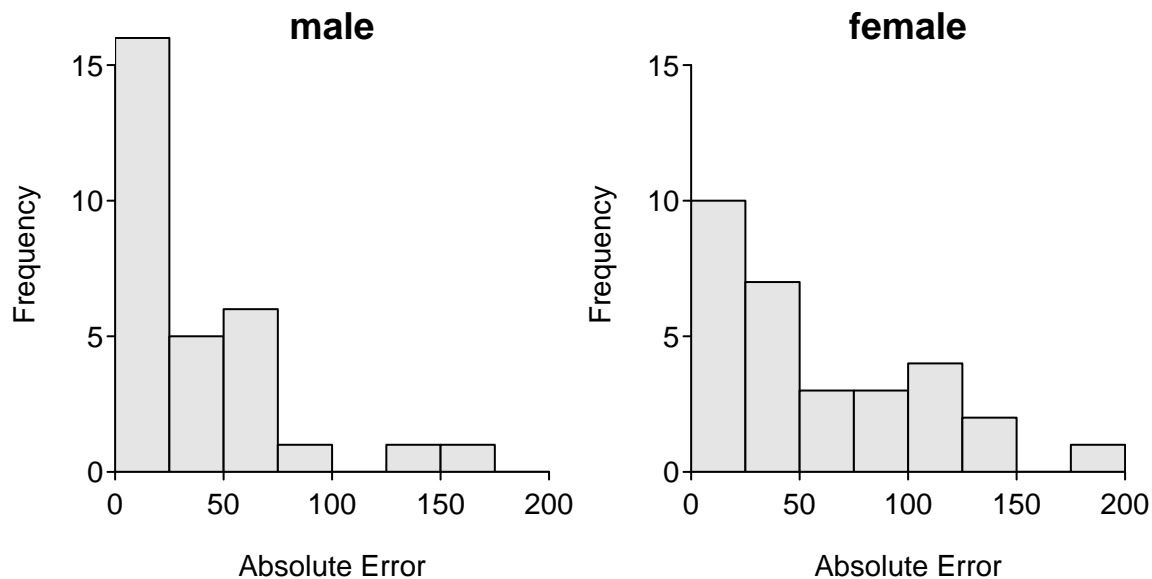
```
[1] "male" "female"
```

```
> levels(sdir$sex)
```

```
[1] "female" "male"
```

Two-Sample t-Test (Traditional Method)

```
> hist(abserr~fsex,data=sdir,xlab="Absolute Error",breaks=seq(0,200,25),col="gray90")
```



```
> Summarize(abserr~fsex,data=sdir,digits=2)
```

	fsex	n	mean	sd	min	Q1	median	Q3	max
1	male	30	37.6	38.49	3	11.50	22.5	58.75	167
2	female	30	55.8	48.26	3	15.75	35.0	88.25	176

```
> levenesTest(abserr~fsex,data=sdir)
```

Levene's Test for Homogeneity of Variance (center = median)

	Df	F value	Pr(>F)
group 1	1	2.1692	0.1462
	58		

```
> t.test(abserr~fsex,data=sdir,var.equal=TRUE)
```

Two Sample t-test with abserr by fsex
t = -1.6149, df = 58, p-value = 0.1118
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-40.758823 4.358823
sample estimates:
mean in group male mean in group female
37.6 55.8

```
> t.test(abserr~sex,data=sdir,var.equal=TRUE)
```

Two Sample t-test with abserr by sex
t = 1.6149, df = 58, p-value = 0.1118
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-4.358823 40.758823
sample estimates:
mean in group female mean in group male
55.8 37.6

Two-Sample t-Test (As a Linear Model)

```
> lm1 <- lm(abserr~fsex,data=sdir)
> summary(lm1)
```

Coefficients:

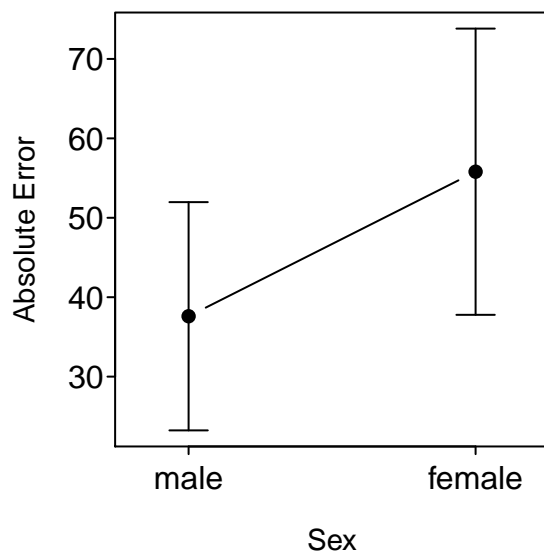
	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	37.600	7.969	4.718	1.54e-05
fsexfemale	18.200	11.270	1.615	0.112

Residual standard error: 43.65 on 58 degrees of freedom
Multiple R-squared: 0.04303, Adjusted R-squared: 0.02653
F-statistic: 2.608 on 1 and 58 DF, p-value: 0.1118

```
> confint(lm1)
```

	2.5 %	97.5 %
(Intercept)	21.648503	53.55150
fsexfemale	-4.358823	40.75882

```
> fitPlot(lm1,xlab="Sex",ylab="Absolute Error",main="")
```



```
> anova(lm1)
```

Analysis of Variance Table

Response: abserr

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
fsex	1	4969	4968.6	2.608	0.1118
Residuals	58	110496	1905.1		