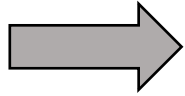


D2

Design and analysis of experiments

SS 2019

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Plot structure?
Treatment structure?
Sketch the DoE

Descriptive statistics
Summaries of the data
Plot the data

Y: numerical outcome
X: categorical explanatory variable
Z: categorical explanatory variable

One-way ANOVA

General idea: $SS_T = SS_B + SS_W$

```
mymodel <- lm(Y ~ X)
```

```
anova(mymodel)
```

One-way ANOVA with blocking

```
mymodel <- lme(Y ~ X,  
  random = ~ 1 | block)
```

```
anova(mymodel, type = «marginal»)
```

Two-way ANOVA with repetitions: interactions

```
mymodel <- lme(Y ~ X*Z,  
  random = ~ 1 | block)
```

```
Interaction.plot()  
anova(mymodel, type = «marginal»)
```

Split-plot design: hierarchical data

```
mymodel <- lme(Y ~ X*Z,  
  random = ~ 1 | large.block/small.block)
```

```
Interaction.plot()  
anova(mymodel, type = «marginal»)
```

Check assumptions of final model

- Observations are mutually independent
- Residuals are normally distributed (e.g. qqPlot(resid(mymodel)))
- Homoskedasticity (e.g fitted vs residual plot)

Extract information

```
summary(mymodel)
```

```
fixef()
```

```
confint()
```

```
coef(mymodel)
```

```
ranef()
```

```
predict()
```

Conduct comparisons

```
TukeyHSD(mymodel, «treatment»)
```

```
multcomp::glht()
```

```
emmeans()
```