


Day 2: Topic 2

Linear Mixed Models for Experiments

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Mixed Models

- Mixed models include:
 - Fixed effects
 - Random effects
- A experimental designs with all fixed effects factors have only one random effect, the error term (ie the residual)
- However, often there is more than one random effect and a mixed model can be used to analyze the experiment.


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Differences from Other Mixed Linear Models

- With other linear models
 - The purpose is to predict the y-variable.
 - The data are observational data and it is difficult to predict cause and effect
- With experiments
 - The data are from designed experiments where the response due to treatment is of interest
 - The experimental data are used to demonstrate cause and effect


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Using A Mixed Model

- Generally, any experiment where there is more than just one random effect (ie more than just the residual) should be analyzed using a mixed model
- Example 1: The treatment is applied to an experimental unit, but samples are taken from each unit (eg plots are experimental units, and then we measure trees)
- Example 2: One or more factors is a random effect factor, where we are interested in the variance due to that factor
- Example 3: Split plots where there is an error at the whole plot and other at the split plot

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What are we looking for?

Generally, for random effects, we want:

- Variance estimates of all random effects
- Tests to see if any random effects have a zero variance

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What are we looking for?

For fixed effects, we want:

- To test whether there is a difference among means of the response variable, then which treatments differ
- Treatments may be subdivided into main and interactions, if there are many factors in crossed, nested or split plot experiments, and there would be tests for each main and interaction effect.
- We may also want confidence intervals around each treatment (or factor level) mean.

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Analysis of Experiments Using a Mixed Model and R

- For more complex experiments, a modelling approach can be used in R
- First, all factors, random and fixed, and any covariates (and interactions) can be added to the model
- Then, through logical processes of elimination, reduced models are fitted.

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Analysis of Experiments Using a Mixed Model and R

A comparison of the full and reduced model indicates whether the dropped factor had:

- A variance equal to zero for a random effect
- All effects equal to zero (ie means are all equal) in the case of a fixed effect.

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