Unit 5: The General Linear Model

4. Mixed Effects Models

4/15/2020

Recap from last time

1. When outcome variables are categorical and binary, we use can use logistic regression
2. Logistic regression is one of a family of models called Generalized Linear Models that often apply when the assumptions of linear regression fail
3. This is an extremely general statistical method that you'll be able to use in almost all of the cases you're likely to work with

Key ideas

1. Mixed effects models are a method for statistically modeling the factors that make everyone the same (what we've done so far) while accounting for the ways in which everyone is different.

2. Fixed effects are things that you think are universal (or you experimentally manipulated),
   Random effects are things that you think might vary across people. The same factor can contribute to both.

3. This is an active area of research in statistics, and the solutions are less tidy (but also probably less wrong)
   than the models we have used so far

A visual introduction to mixed effects models

Go to this link, read through it at your own pace.

http://mfviz.com/hierarchical-models/

We'll come back in ~8-10 minutes and talk about it

The core idea: control for violations of independence

Conditions for linear regression: Linearity, Normal Residuals, Constant variance, and **independence**.

- We have assumed that all of our data are independent. But often this is not the case
  - More than one measurement from the same person
  - Effects of the particular experimental stimuli
  - Effects of our experimental manipulation that depend on the person
  - etc.

We can treat these as random effects and try to estimate them instead of closing our eyes and assuming them away

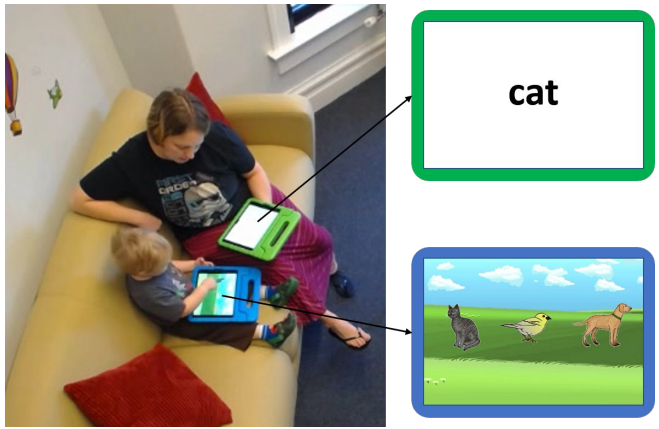
Modeling random effects

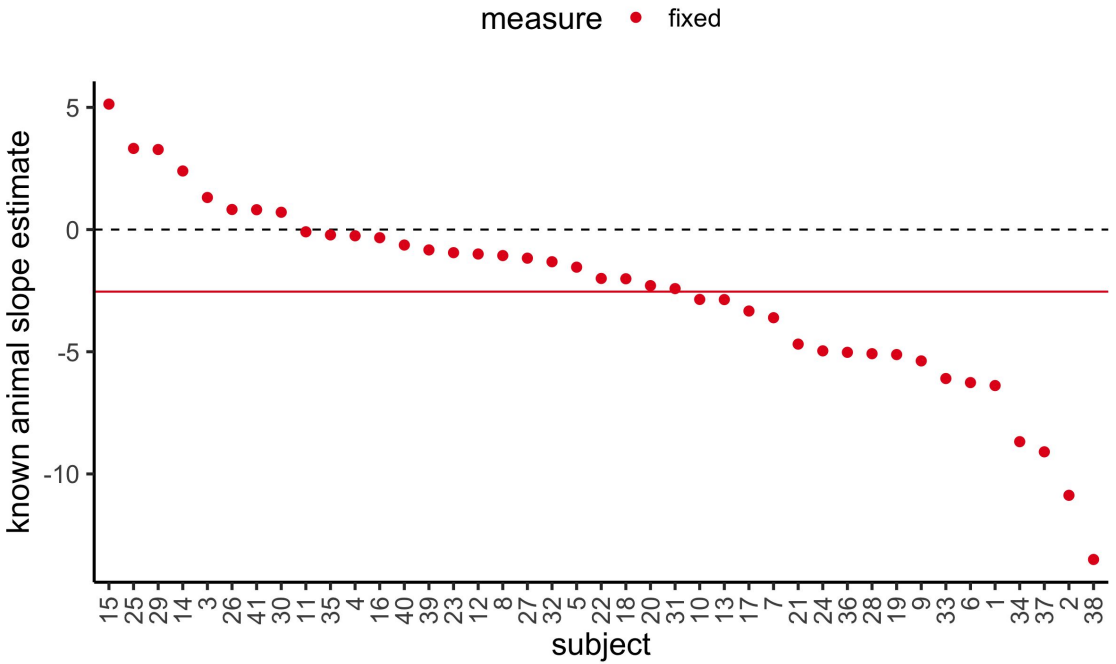
For *fixed effects*, we want to estimate them because we care about the estimate (e.g. the effect of hours worked on income).

We want to model *random effects* so that we can better estimate the fixed effects, but we generally don't care so much about their estimates.

For this reason, we use a method called *partial pooling* which treats random effects as noisier than fixed effects, and estimates them by partially combining estimates across people

An example from the Animal Game data





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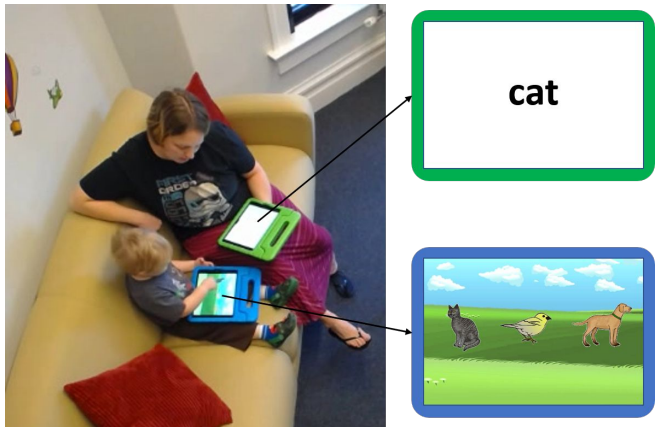

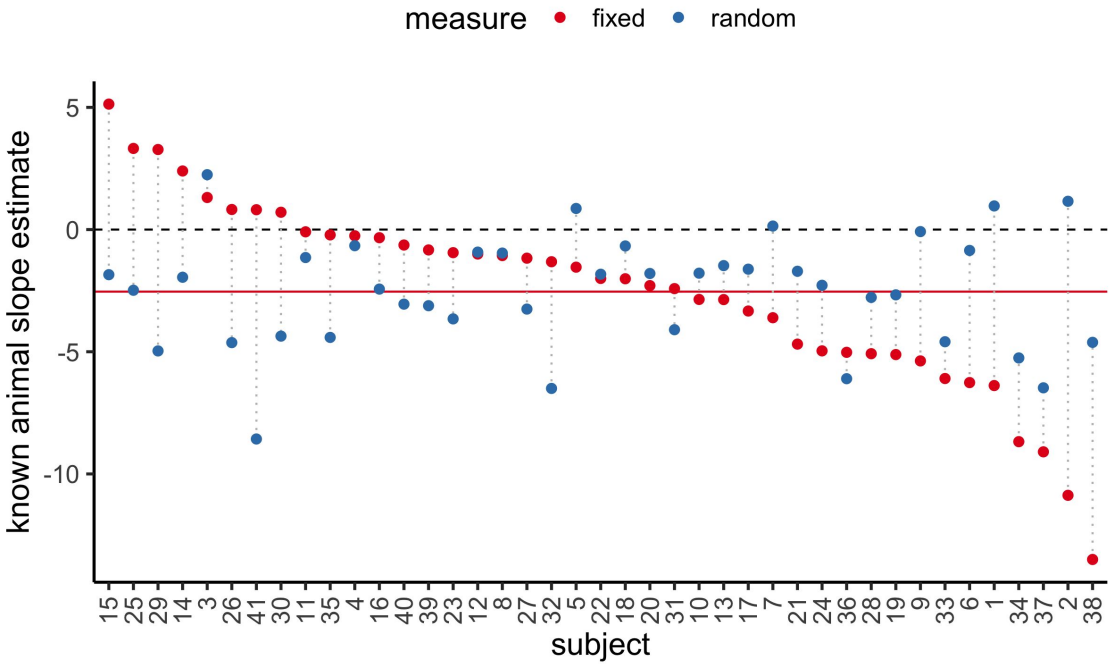

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