Mixed Effect Models: R Syntax

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1 Introduction

The function that we shall use for grouped data will require you to write down two formulae, one of them is fixed and other one is random.

In the fixed part you will be encoding the little designed matrix from our example:

$$\begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

So if we call y as amount(amt) then we can write

$$\text{Fixed=amt} \sim \text{method}$$

We are not writing 1 as the intercept term is already considered. So this will give you μ,α_1 and α_2.

Now comes the counter intuitive thing. When you look at the random part, it is just $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ column. Then according to R's notation it is simply 1. So you write

$$\text{random=}\sim 1|\text{tab}$$

This gives us the grouping variable. In our example the grouping variable is tablet (tab). Also observe that since we have got only one output and that is already specified in the fixed part, it is not necessary to specify it again. In fact, you are not allowed to specify it again. You have to write a one-sided formula with the tilde and the only thing after that, and the grouping variable is always written after the vertical bar. So this is the syntax we will use when we use R.

2 The "Factoring" Trick

There is a simple way of remembering how to construct that random effect formula in R. We illustrate this with one example:
Suppose we have this model:

$$y_{ijkl} = \mu + \alpha_i + \beta_j + \gamma_{ijk} + \epsilon_{ijkl}$$

where you know that the cause behind using random effect is the variable j. So anything which involves j, you will make that random effect.

How do you write this in R?

The first thing you have to write is the fixed part and you do that just in the usual way. You just write

$$\text{Fixed}=y \sim 1 + i$$

You may omit 1. We are just writing it for completeness. 1 is for μ and i is for the variable α_i. So the fixed part is straight forward.

Now we look at the random part. j is the reason why you are doing this so you factor j out. See whatever remains. So,

$$\text{Random}=\sim 1 + i : k|j$$

In the above expression, 1 occurs because once you have factored j out, β is just on its own. We write β instead of β_j. That is like the intercept term.
Interaction between i and k is denoted as $i : k$. Notice that we are not putting j. All the j's are factored out after the vertical bar.

So in this method, you don't have to think about all those designed matrix and sub-designed matrix. We can routinely write down what you need easily even in a complicated case.