

# Video 144 Summary

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## 1 Overview

Here we shall look at how to fit Mixed Linear Models in R . As our learning example we shall take the data from the ” Tablet ” experiment that we have seen earlier .

tab	HPLC	NIR
1	10.4	10.1
2	10.6	10.8
3	10.2	10.2
4	10.1	9.9
5	10.3	11.0
6	10.7	10.5
7	10.3	10.2
8	10.9	10.9
9	10.1	10.4
10	9.8	9.9

## 2 Formulation

The Linear Model we used was as following :-

$$y_{ij} = \mu + \alpha_i + b_j + \epsilon_{ij}$$

The methods are encoded as  $i$  while the tablets are encoded as  $j$  . So  $i$  takes 2 values (1,2) ( for **HPLC** and **NIR** methods ) and  $j$  takes 10 values

(1-10) for 10 tablets . Note that here we have assumed that the effect due to  $j$  is a random effect . The **Design Matrix** for this Model will look like the following :-

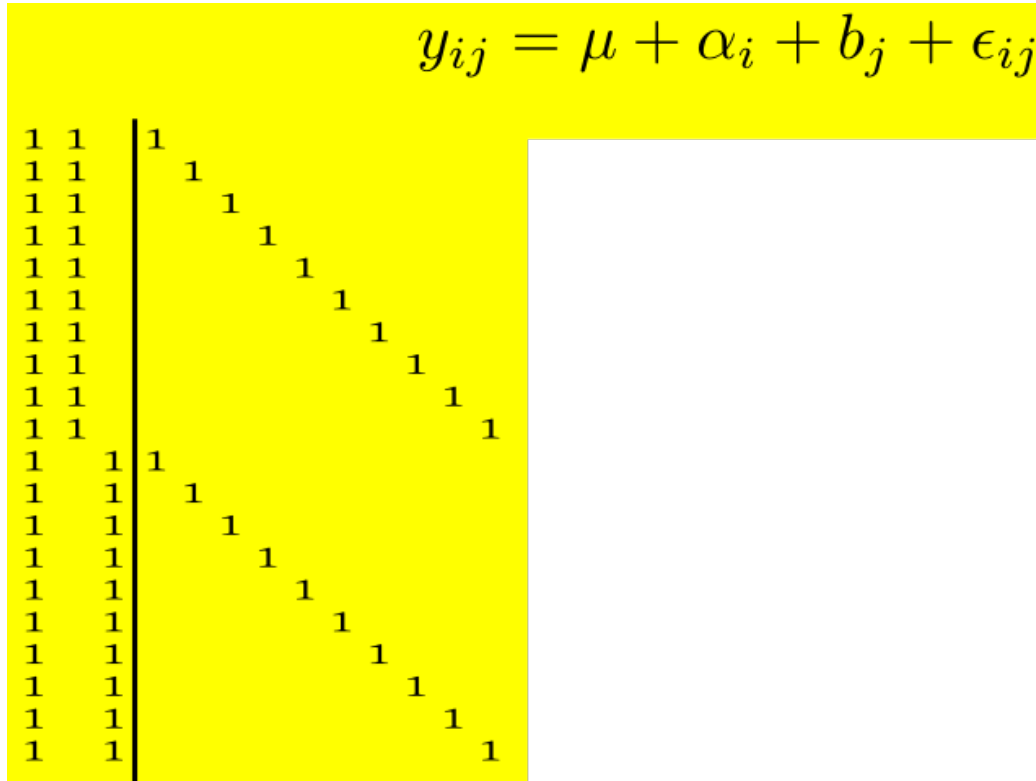


Figure 1: **Design Matrix**

Now note that the matrix to the left of the vertical line is our design matrix  $\mathbf{X}$  for fixed effects (columns for  $\mu, \alpha_1, \alpha_2$ ) while the design matrix on the right  $\mathbf{Z}$  (10 columns for  $j$ ) is for random effects ! ( **Note that the 1st and 11th lines in the design matrix correspond to Tablet 1 , 2nd and 12th corresponds to Tablet 2 and so on .** )

So in order to specify the Mixed Effects Model in **R** we need to specify two design matrices . However for this purpose unlike other standard software ,

**R** uses the concept of **Grouping** and the syntax for which is quite counter-intuitive .