Design of Experiments

The principles and techniques of linear models are straightforward in theory, but when we implement them in a practical scenario, we often come across hurdles.

Say, for example, we have a system with 5 factor inputs as shown in the figure.

Let the number of levels of the $i-th$ factor be k_i. If we want to apply the principle of blocking, we will proceed by changing each one of the input factors, while keeping the others fixed. In this way, we will keep the inputs fixed at all possible combinations and repeat the experiment to allow the random error to vary and show itself. Hence, in order to perform a repeated measures experiment k times (where the $i-th$ factor has k_i levels), we will need $k_1 \times \ldots \times k_5 \times k$ many measurements. For this, we will need k units from each of the $k_1 \times \ldots \times k_5$ many blocks. This means our required sample would have to be sizeable enough and well organised, which in a real scenario, is almost unfeasible. To overcome this problem, statisticians cleverly implement the known principles, such that the final conclusion still remains valid up to some degree.

The subject 'design of experiments' concerns the real-life application of principles and techniques of linear models. We shall learn this in detail in the next semester.