Nelder (1965a, b)

The analysis of randomized experiments with orthogonal block structure, *Proceedings of the Royal Society of London, Series A*

Fundamental work on the analysis of randomized experiments with orthogonal block structures

1-1

Bailey (1981) *JRSS, Ser. A*

"Although Nelder (1965a, b) gave a unified treatment of what he called 'simple' block structures over ten years ago, his ideas do not seem to have gained wide acceptance. It is a pity, because they are useful and, I believe, simplifying. However, there seems to be a widespread belief that his ideas are too difficult to be understood or used by practical statisticians or students."

1-2

Experimental Design

1. correct
2. answer your question

Planning of experiments to produce (valid) information as efficiently as possible

maximum amount of information from available resource.

Comparative Experiments

compare the "difference" between treatment means

recall:
· ANOVA
· multiple comparison.

- Treatments 處理

  Varieties of grain, fertilizers, drugs, ….

- Experimental Units

  Plots, patients, ….

- Observational Units

1-3

Bailey, Chapter 1, Section 4.

Def: A <u>treatment</u> is the entire description of what can be applied to an experimental unit.

Def: An <u>experimental unit</u> is the smallest unit to which a treatment can be applied.

Def: An <u>observational unit</u> is the smallest unit on which a response will be measured.

Ex 1.6: Wheat varieties.
- compare different varieties of wheat grown in plots in a field
 treatment: varieties of wheat
  exp'tal unit: plots
  obs'nal unit: plants/plots/field

1-4

Ex 1.5: Rye-grass
- compare three different varieties of Rye-grass in combination with 4 quantities of fertilizer
- response measured: total weight from each plot
- 2 fields, 3 strips, 4 plots

one variety
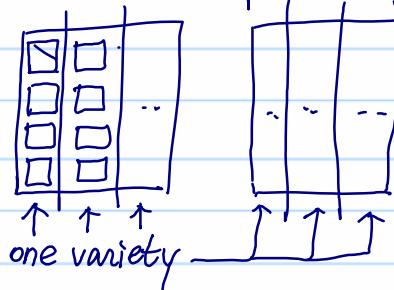
treatments: 12 combinations of varieties & fertilizer
exp'tal units: plots / strips & plots
obs'nal units: plants / plots / strips / fields

1-5

Ex 1.2. Calf-feeding individually
- each calf was weighted several times (0, 6 months, 12 months, ⋯)
- different composition of feed
  compare
- ten calf per pen, each pen allows a type of feed

     treatment: feed
     exp'tal units = pens
     obs'nal units: combinations of calf & times.

Ex 1.7. Asthma
- several patients take part in an exp't to compare
- several drugs
- each patient, drugs changed each month
- each time patient come to clinic, peak flow rate in lung is measured
     treatment: drugs
     exp'tal units: combination of patient & month
     obs'nal units: patient & clinic

1-6

Ex1.8. Mental arithmetic
- two remedies : whole-class session / small group
    timing: one hour per week / 10-12 min a day
- each child take a test after some set time
    treatment : combination of remedies & timing
    exp'tal units: whole class
    obs'nal units: children / whole class

Ex1.9. Detergents
- ten housewives test new detergents
- each housewife test one detergent per washload for
    each of 4 washloads
- assess the cleanliness of each washload

    treatment : detergents

    exp'tal units: washloads

    obs'nal units: washloads

Ex1.10. Tomatoes.
- different varieties of Tomatoes grown in pot in
    different composts with different amount of water
- 5 plants wound around same rail
- weight of saleable tomatoes per rail
    treatment: combination of varieties, composts, water
    exp'tal units: pots
    obs'nal units: rails

case(i): exp'tal unit = obs'nal unit
case(ii): exp'tal unit consists of several obs'nal units
case(iii): obs'nal = ` = = exp'tal =
case(iv): exp'tal & obs'nal units have a partial overlap
    but neith is contained the other.

Def: For cases (i) & (ii), an obs'nal unit is called plot

Notation : lower-case Greek letter to denote plot, $\alpha, \beta, r. \omega, \cdots$
whole set of plots denoted by Ω , # of plots $= N$

treatment structure

plot structure
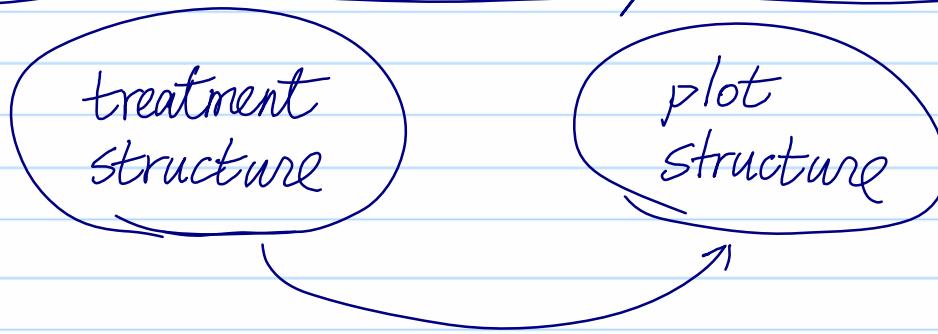
assignment.
(randomization)

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