To call in the statistician after the experiment is done may be no more than asking him to perform a post-mortem examination: he may be able to say what the experiment died of.

Sir Ronald Fisher

Presidential Address to the First Indian Statistical Congress, 1938. Sankhya 4, 14-17

(BUT maybe you don't need to call in a statistician if you know some principles)

When assumptions are not met

Timothée Bonnet

Biological Data Science Institute

May 2, 2019

If you haven't enough R in your life

https://www.meetup.com/rladies-canberra/events/dvrjwqyzhbjb/

6 MAY

Monday, May 6, 2019

Tidying and plotting in R

Hosted by Petra K. and 2 others
From R-Ladies Canberra
Public group

Are you going? 18 people going

Share:

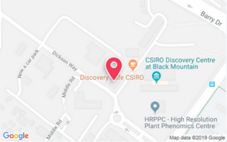
Details

R is primarily known as a tool for statistics and data analysis, but it is also great for "simpler" data wrangling and plotting purposes. As R is becoming more accessible and useful in this regards, it is becoming a more viable alternative to Microsoft Excel and other spreadsheet-based applications for wrangling,

Monday, May 6, 2019
1:00 PM to 2:30 PM
Every week on Monday until May 12, 2019

CSIRO - Synergy Building
N Science Rd · Acton

How to find us
Stringybark, Building 801, Cnr of Dickson Way and, N Science Rd, Acton ACT 2601



Take-home messages

1. Assumptions are about math properties, but also about scientific logic

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Statistical inference: General approach

1. Scientific question

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↓

2. Model and Statistical question

Statistical inference: General approach

1. Scientific question

$\downarrow$

2. Model and Statistical question $\longleftrightarrow$ 3. Data collection

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4.a Estimation

4.b Uncertainty and statistical significance

Statistical inference: General approach

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2. Model and Statistical question ⟷ 3. Data collection

4.a Estimation

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5. Prediction, diagnostic, check assumptions

Until "good enough"

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Until "good enough" to trust 4.a and 4.b

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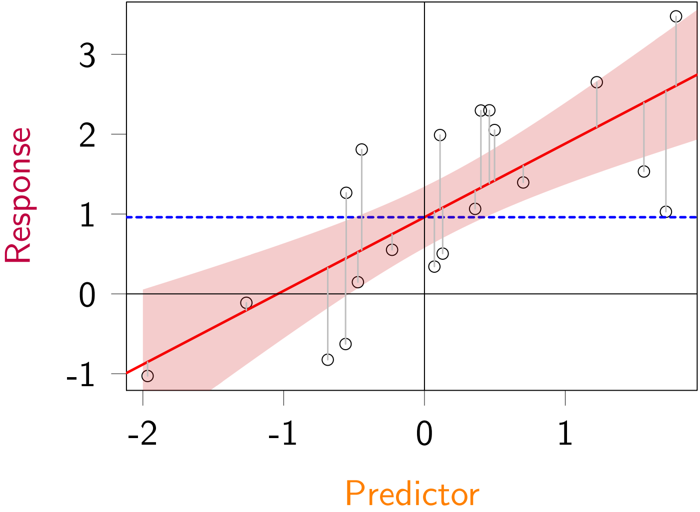
Until "good enough" to trust 4.a and 4.b

6. Interpret and think about the biology

Simple linear model

Response = **Intercept** + **Slope** × **Predictor** + **Error**



What are linear model assumptions?

Linear model assumptions

Assumptions do NOT include:

- Relationship is a straight line ("Linear" means a line on some scale, not any scale)
- Data normality (Only error normality)
- Collinearity (Changes parameter meaning, not the validity)

Linear model assumptions

- Linear combination of parameters (including transformation, polynoms, interactions. . .)
  Risk: biologically meaningless
- Predictor not **perfectly** correlated
  Risk: Model won't run, unstable convergence, or huge SE
- Little error in predictors
  Risk: bias estimates (underestimate with Gaussian error)
- Gaussian **error** distribution
  Risk: Poor predictions, wrong uncertainty
- Homoscedasticity (constant error variance)
  Risk: Poor predictions, wrong uncertainty
- Independence of error
  Risk: Bias and over-optimistic uncertainty

Exercise 1

Residual distributions

Exercise 1

Exercise 2

Exercise 3

Non-independence

Exercise 3

Exercise 4

Let's think about more complex issues

Problems / Detection / Typical solutions:

- Non-Linear relationships / Thinking
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- Correlated errors Thinking (/plot)
  Solution: Experimental design / control variables / mixed models

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