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Problems with Correlations in Relative Data and a Proposed Alternative

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The Papers

Proportionality: A Valid Alternative to Correlation for Relative Data

David Lovell, Vera Pawlowsky-Glahn, Juan Jos Egozcue, Samuel Marguerat, and Jrg Bhler

PLoS Computational Biology 11(3) (2015)

Proportions, Percentages, PPM: Do the Molecular Biosciences Treat Compositional Data Right?

Lovell DR, Muller W, Taylor JM, Zwart AB, Helliwell CA

Compositional data analysis: Theory and applications p193-207 (2011)

Section 1

Introduction to the Problem

What is Relative Data? –Also called "Compositional Data"

- Compositional data are vectors of non-negative components showing the *relative* weight or importance of a set of *parts in a total*
- The total sum of a compositional vector is considered irrelevant, or an artifact of the sampling procedure.
- No individual component can be interpreted isolated from the other. A composition carries no absolute information on increment/decrement of mass.

Is *my* data relative??

Relative data arises naturally in many biological measurements:

- Is your sample oa fixed size?
  - 1 gram of tissue
  - 1 μg of total RNA
  - 1 μg of metagenomic DNA
  - 1 mL of blood, etc.

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Then your data might be relative!

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Yes

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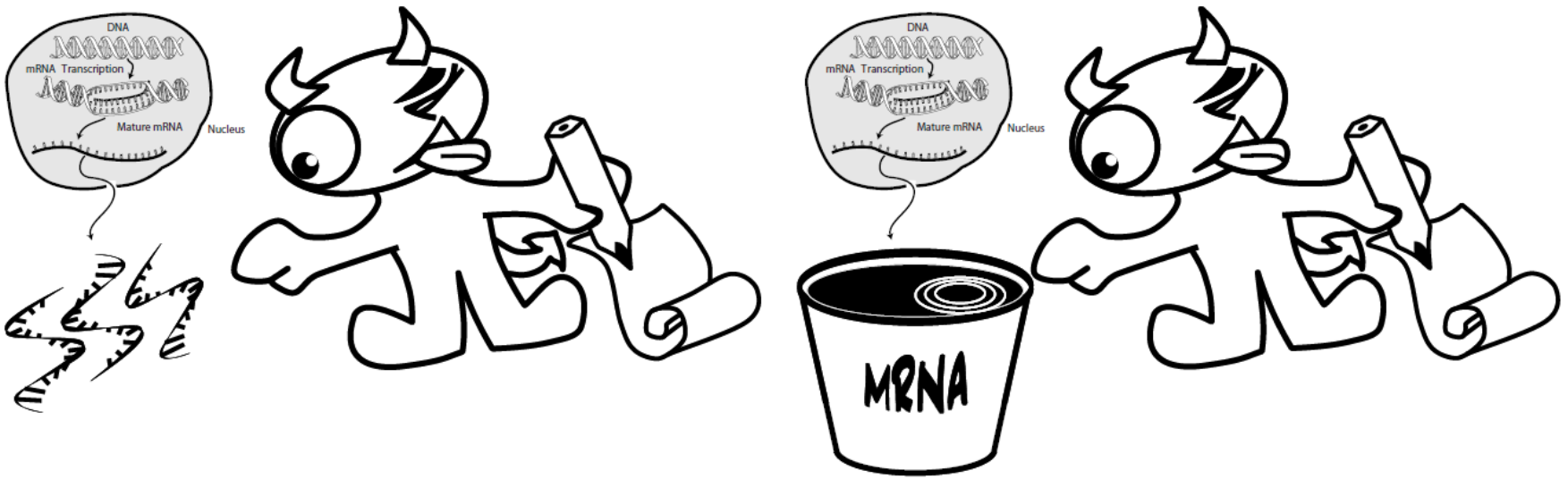
Long answer: It depends...

In certain cases it doesn't matter much but in others it matters a lot.

The 'Omics Imp'

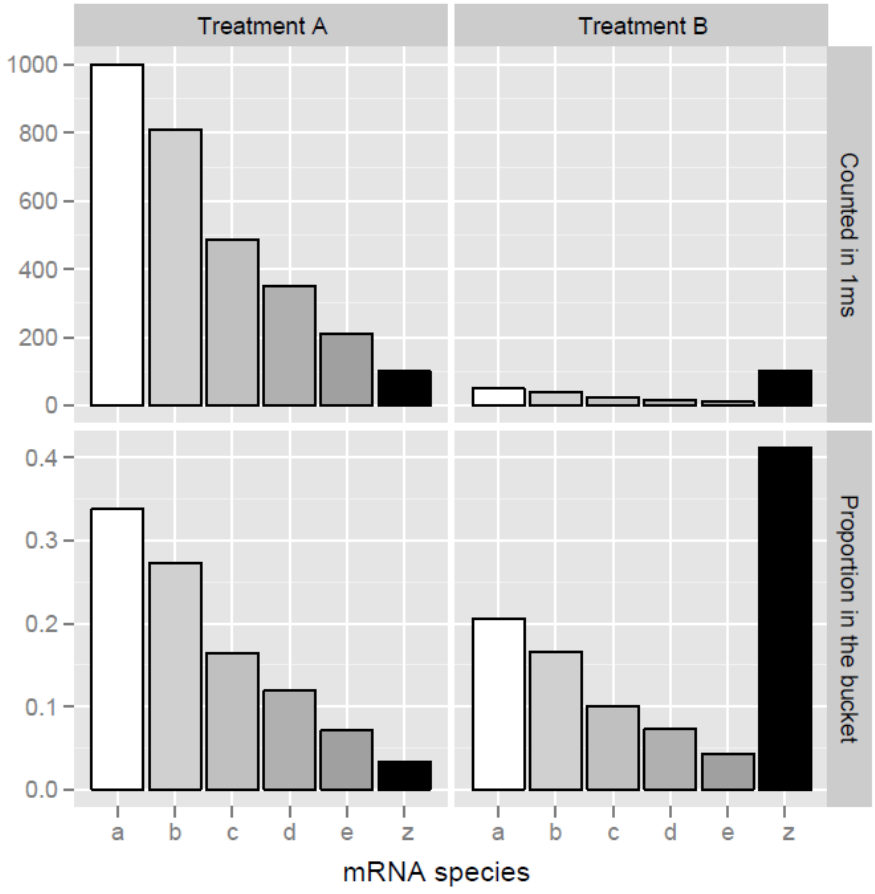
Lovell et al.



- On the left the imp tallies sequences as they are produced in a fixed time period
- On the right the imp counts the sequences in some fixed size bucket
  - Data on the right are parts of a total

Relative data can be misleading

Example 1.



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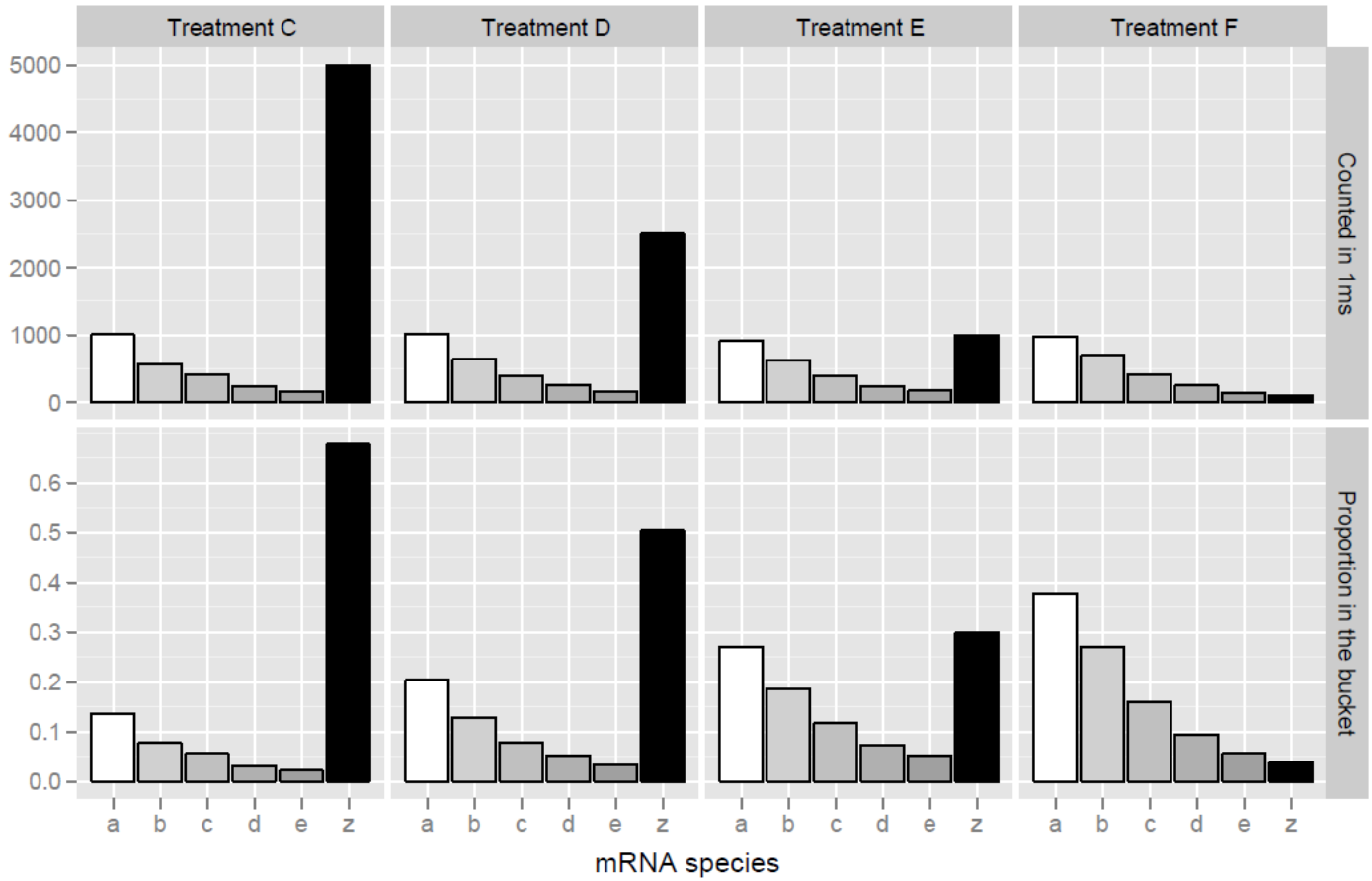
Example 2.



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  - Correlation is attenuated

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- $c_1, c_2 \gg c_3$
  - As $c_1 \uparrow$ then $c_2 \downarrow$
  - Correlation is attenuated
- $c_3 \gg c_1, c_2$
  - Here $var\,(c_3)$ dominates the composition
  - Correlation is biased high as $var\,(c_3) \uparrow$

Correlations on Relative Data

Yes, I am going to show a slide show during a slide show.

David Lovell scaring you about correlating proportions

When can I mostly ignore the relative nature of my data?