Compositional data, Bayesian inference and the modeling process

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Statistical modeling in practice encompasses both the exploratory process, which is an inductive scientific approach and the confirmatory modeling process, which uses the deductive scientific approach. This paper will focus primarily on the confirmatory modeling process.

As the great applied statistician George Box, has famously said "all models are wrong, but some are useful". My version would be "all models are wrong, but some are essential for progress"!

While John Aitchison has changed the world of compositional data analysis, the world of Bayesian statistics has also changed dramatically thanks to the Gibbs sampler, which allows Bayesian analysis of complex non-linear models and particularly random effects models.

The beauty of Bayesian analysis is that it allows us to build models hierarchically to incorporate all our knowledge about the structure of the data generation process, not just about the parameters.

In practice, we often know quite a lot about how data might have been generated and that knowledge can make a dramatic difference in how precise our inference can be.

The paper examines the use of Bayesian inference in statistical models that include a compositional process. It discusses the insights that may be obtained from this approach, including as examples: distinguishing between structural and censored zeros, examining the choice between compositional or multivariate covariates, identifying the number of end-members in a composition and identifying change-points in compositional processes.

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