

# Experimental Design on the Simplex

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Optimum experimental designs depend on the design criterion, the model and the design region. The talk will consider the design of experiments for regression models in which there is a single response with the explanatory variables lying in a simplex. One example is experiments on various compositions of glass such as those considered by Martin, Bursnall, and Stillman (2001).

Because of the highly symmetric nature of the simplex, the class of models that are of interest, typically Scheffé polynomials (Scheffé 1958) are rather different from those of standard regression analysis. The optimum designs are also rather different, inheriting a high degree of symmetry from the models.

In the talk I will hope to discuss a variety of modes for such experiments. Then I will discuss constrained mixture experiments, when not all the simplex is available for experimentation. Other important aspects include mixture experiments with extra non-mixture factors and the blocking of mixture experiments.

Much of the material is in Chapter 16 of Atkinson, Donev, and Tobias (2007). If time and my research allows, I would hope to finish with a few comments on design when the responses, rather than the explanatory variables, lie in a simplex.

## References

- Atkinson, A. C., A. N. Donev, and R. D. Tobias (2007). *Optimum Experimental Designs, with SAS*. Oxford: Oxford University Press.
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- Scheffé, H. (1958). Experiments with mixtures. *Journal of the Royal Statistical Society, Ser. B* 20, 344–360.