# The ritools package: Tools for Exact and Randomization Inference

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Tests based on randomization (or permutation) are very attractive for the conceptual simplicity of their foundations and for the paucity of assumptions they require of the data analyst. However, such tests have not had widespread acceptance among political scientists, sociologists, and economists, despite their long heritage in statistics. One impediment to wide use of such tests has been that they are seen as computationally burdensome. This problem is disappearing at nearly the rate of Moore's law. Other reasons for avoiding these tests have arisen from essentially their user interface: compared to the unified framework of the generalized linear model, the tests of Fisher; Cochran, Mantel, and Haenszel; McNemar; and Wilcox seem confusingly unconnected (and unruly). Adaptations of the linear model seem more conceptually elegant than choosing from a grab bag of named techniques. Finally, another reasons for the lack of engagement between social scientists and randomization inference has been the scarcity of datasets generated using random assignment in the research design, which is the design that provides the firmest foundation to randomization inference techniques. Recently, however, more and more random assignment is being done in the social sciences, and new developments in the analysis of observational studies are allowing randomization inference to compete with other modes of testing and estimation.

Our presentation will discuss the design and use of an R package containing Randomization Inference Tools ("ritools"), which aims to overcome a few of the problems mentioned above — namely the user interface problem, and some of the computational complexity problems. We will describe the package and some of the challenges that we've overcome in its creation. And we will show it in operation in two modes: (1) testing for balance during the application of optimal, full matching [using the "optmatch" package], and (2) estimating treatment effects for binary responses using Rosenbaum's "attributable effects" framework (Rosenbaum 1991).