CONDUCTING ANOVAS WITHOUT DATA

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ABSTRACT

We present a simple method for conducting factorial ANOVAs in the absence of data. The method relies on descriptive statistics, namely the mean, variance, and sample size for each cell in the design. We briefly describe how this method can easily generalized to any number of factors, allowing us to analyze n-way factorial ANOVAs with any number of interactions. We then introduce the idea that this method allows us to (a) perform ANOVAs from existing studies that did not themselves perform ANOVAs and (b) combine descriptives from multiple studies in order to cumulate them into a sort of meta-analytic ANOVA.

Keywords: *Analysis of Variance, Factorial ANOVA, Meta-Analysis*

1. INTRODUCTION

Ralston, Pounder, Lo, Wong, Egri, and Stauffer (2006) conducted a longitudinal study of managerial values systems in the U.S., Hong Kong, and mainland China. Specifically, they compared information from 1989 with data collected in 2001. Unfortunately, the data collected in 1989 had been lost, but the team had the descriptive statistics from an article they published a few years later (Ralston, Gustafson, Cheung, and Terpstra, 1993). As part of their longitudinal study, the team wanted to conduct a two-factor Analysis of Variance (ANOVA) to compare differences in reported values between the two time intervals, 1989 and 2001. They approached a psychometrician to see if the ANOVA could be done using only the descriptive statistics from the original study. The answer was yes.

Ralston et al. (2006) briefly described in an endnote how this can be done for a two-factor ANOVA. But it can be done for more than two factors, as long as the descriptive statistics include the means, variances (or standard deviations), and sample sizes for all the cells in the study design. And, of course, it can be done for simpler 1-factor main-effects ANOVAs, which do not have to deal with interaction effects.

The paper further describes how this methodology allows researchers to perform ANOVAs on published studies that could have, but did not, perform ANOVAs, i.e., when those studies' designs comport with the structure of main-effects and factorial ANOVAs and report the necessary descriptive statistics. We also introduce the idea of using this methodology as a sort of meta-analysis to cumulate findings across studies that either employed ANOVAs themselves or did not employ ANOVAs but reported the requisite descriptive statistics to conduct an ANOVA. Both of those types of studies can be used together in a cumulative ANOVA.

2. THE BASIC METHOD

The method for conducting ANOVAs without the data is made clear by a close examination of the formulas laid out in such standard statistics texts as Hays (1963) and by the realization that the role of the raw data is to produce the descriptives in the first place. The actual ANOVA calculations do not begin until the data are all collected and collapsed into cell means, sample sizes, and variances. So what we are calling analysis without data (AWD) is simply a natural part of any ANOVA. It is just that someone else has done the first step for us.

We begin by examining the formulas for a two-factor ANOVA. A fixed-effects model is assumed throughout for the sake of simplicity to avoid obfuscating the utility of this ANOVAs-without-data (AWD) approach.