Ph.D. Program in Speech-Language-Hearing Sciences

Fall 2020 Colloquium

Wednesday, September 23, 2020

2:45pm-4:00 p.m., via ZOOM

Jay Verkuilen

Graphical Data Analysis for Reaction Times

Response times are widely used in psychology, education, and related disciplines and have been for well over a century, since pioneering 19th Century studies by Donders, Fechner, and C. S. Pearce, among others. Nevertheless, analysis of RTs has been an object of some difficulty for most of this time. RTs are long-tailed with SD proportional to mean (Wagenmakers & Brown, 2007); subject to substantial individual heterogeneity; involve a mixture of false starts, attention wanders, and viable RTs; contain accurate versus inaccurate trials in decision tasks; and need to account for non-decision time latency (shift). All these things make choosing an appropriate statistical model quite challenging. Models such as the diffusion model (Ratcliff & Tuerlinckx, 2002) can accommodate all these aspects, but are formidable to fit and use.

Fife (2020) offered eight points towards improving graphical data analysis in psychology, which he argues is essential for good data analysis, especially for model choice and assessment. He notes that "statistical analysis requires a rather large toolbox in which each tool is adapted to the circumstances under which it is most appropriate" (p. 2). Unfortunately, most of the widely used graphical analysis tools are not well-adapted to the kinds of problems presented by RTs and thus require adaptation. For instance, the widely used boxplot has an implicit assumption of near-Gaussian data. As noted before, RTs are markedly non-Gaussian and are generally not easily transformed to be Gaussian, especially in the presence of notable shift. Thus, boxplots of raw RTs will often hide important features of the data or exaggerate other features that are not important, e.g., declaring points as outliers which are ordinary parts of the distribution's tail. We make use of known properties of RTs to adapt these graphical tools. The resulting analyses are familiar but are more amenable to the human eye than analyses of raw RTs or of inappropriately transformed RTs. Data from the English Lexicon Project (Balota et al, 2007) are used to illustrate our points. R code and data will be available for our examples.

The Graduate Center
365 Fifth Avenue
New York, NY