On Reproducibility of Research Findings, Boundary of Meaning and Type S Errors

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Aula Virgilio (Dibit 1)

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Abstract

The question of reproducibility of research outcomes is discussed now in the open press with a potential negative impact on science as a whole. In dealing with this question, from a statistical view point, several methodological advances have been proposed (like FDR) and several clarification attempts have been published (like the ASA statement on the p value). These attempts seem to only partially address the rising concerns of the public and research funding agencies.

Kenett and Shmueli in *Clarifying the terminology that describes scientific reproducibility, Nature Methods, 12(8), p 699, 2015*, review the terminology used in this debate and refer to generalizability, as a dimension that can clarify what are research claims that should be scrutinize as reproducible. Generalizability is one of the eight dimensions of the information quality (InfoQ) framework presented in Kenett and Shmueli, *On information quality: The Potential of Data and Analytics to Generate Knowledge*, John Wiley and Sons, 2016.

In this talk, we expand on the idea of generalizability of research findings by referring to Type S errors proposed in Gelman and Carlin (2014) [*Beyond power calculations: Assessing Type S (sign) and Type M (magnitude) errors, Perspectives on Psychological Science, Vol. 9(6), pp. 641–651*]. The talk will first discuss methods for setting up a boundary of meaning used in generalizing research findings. It will then show how Type S errors and directional FDR methods fit with this generalizability approach. An example from research in localized colon cancer diagnostics will be used to demonstrate the approach. https://www.ssrn.com/abstract=3035070

Professor Ron Kenett, Chairman of the KPA Group, Senior Research Fellow, Samuel Neaman Institute, Technion and Visiting Professor, Institute for Drug Development, Hebrew University of Jerusalem, Israel. He is Past President of the *Israel Statistical Association* (ISA) and of the *European Network for Business and Industrial Statistics* (ENBIS). Ron authored and co-authored over 200 papers and 12 books on topics ranging from industrial statistics, biostatistics, customer surveys, multivariate quality control, risk management and statistical methods in healthcare. He held academic positions at the University of Wisconsin-Madison, the State University of New York, Binghamton, Tel Aviv University and Bell Laboratories in New Jersey. He was awarded the 2015 Greenfield Medal by the Royal Statistical Society (RSS) in recognition for excellence in contributions to the applications of Statistics and the 2018 George Box Medal by the European Network for Business and Industrial Statistics (ENBIS) for outstanding contributions to the application of statistical methods in European business and industry. He is editor in chief of the Wiley's StatsRef electronic Encyclopedia and associate editor of *ASMBI, Dynamic Relationships Management Journal, Electronic Journal of Applied Statistical Analysis* and *Transactions on Machine Learning and Data Mining*. The methods he developed are incorporated in the *arules* and *mistat* R packages available from CRAN. For more details on his books see: www.amazon.com/author/rkenett