

**Herrero Soler, Honesto, Rosario Martínez Arias & Marian Amengual Pizarro. 2011. *Estadística aplicada a la investigación lingüística (Statistics Applied to Language Research)*. 376 pages.**

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One of the major problems with the use of statistical tools in language related research is the absence of reliable, up-to-date reference sources, the kind of material that is easily accessible and comprehensible for those without special mathematical expertise. For example, we might need to check clear definitions of technical terms, consult tables with critical values, obtain tips on how to organise and present linguistic data, or learn how best to conduct comparisons between groups of subjects using different statistical tests.

The work reviewed here is clearly intended to fill in this gap. It covers a wide range of key questions in language research with precision and rigour but without abandoning its pedagogical perspective. Indeed, the combination of technicality, thoroughness, comprehensiveness and a pedagogical dimension is one of its great assets. Practical and well-informed manuals of this kind are already available, including Muller (1968), Woods, Fletcher and Hughes (1986), and Butler (1985). However, these were first published at least thirty years ago, in languages other than Spanish, and were based on the type of language research being conducted at the time, very different from linguistics in the twenty-first century. More recently has been Gries (2009), also published in English, and whereas it is a valuable contribution to the field, second language learning and teaching is not given the prominence it deserves.

*Estadística aplicada* covers in detail many of those areas typically occurring in the statistical study of language: the basics of scientific research, main statistical designs and techniques, the description of statistical notions (e.g. mean, mode, standard deviation, and variation coefficient), statistical inference, parametric tests, contingency tables, analysis of variance, correlation, and lineal regression. Furthermore, explanations are given in a step by step way, guiding the reader in such a way as to make the whole process easily understood. The authors are not simply interested in showing how and

when a statistical test should be applied, but are concerned with why such tests should be used. The practical exercises and activities provided at the end of each chapter allow readers to reinforce their understanding of theoretical notions and concepts in a hands-on way. It seems clear that the authors of this book not only have long research experience, but are also well acquainted with the problems that postgraduate students, language teachers and other researchers frequently encounter when reading and interpreting research papers, designing projects, presenting information, drawing comparisons between groups, or finding the best possible statistical test or package for the analysis of data.

This manual is organised in eleven chapters, these divided into three sections. The first section, which covers the first two chapters, is of a general nature and is concerned mainly with the general principles that should be considered in any scientific study, the appropriate research designs for different types of studies, and the statistical techniques which are most widely used in the field of linguistics. The second section, which includes chapters 3, 4 and 5, is focused on the organisation, description and presentation of data in language research, as well as on the basic principles of inference and the formulation of research hypothesis. The final section is more extensive than the other two since it contains the remaining chapters, that is, from chapter 6 to chapter 11. It centres entirely on inferential statistics, paying special attention to those tests which are most commonly used in second language learning, e.g. parametric tests, means and proportion contrasts, contingency tables, non-parametric tests for the comparison of groups, ANOVA, correlations, and regression.

Each chapter follows the same structure: a list of the main points to be discussed, an examination of central issues, including useful examples, the presentation of results, a general summary, and practical activities. Moreover, the main questions addressed are set out in tables highlighted in grey. In addition to the eleven chapters of the book, four appendices are included: the first of these presents ten tables of common use (normal distribution, T student distribution,  $X^2$  distribution, Mann-Whitney Bilateral U-test, Mann-Whitney Unidirectional U-test, Wilcoxon Test, Pearson Correlation Coefficient, Spearman Correlation Coefficient, F Distribution for 0.05 gl and F Distribution for 0.01 gl); a list of websites referred either to the critical values of the different distributions or to their direct calculation; a glossary of 220 terms where the English equivalent of the main entries is provided; a section containing the formulae for different statistical calculations such as standard error, Mann-Whitney test, Phi coefficient, Kappa index, variance, variation coefficient, Pearson's contingency coefficient, Pearson and Spearman correlations, etc. A bibliography for the book is also provided.

In terms of layout, the book is attractive in that a large number of tables, figures, charts and screen shots are included, and these definitely help the reader to follow the information presented more easily. The written style of the book is non-technical and reader-friendly. In the following I will deal with each of the chapters separately.

Chapter 1, Scientific Research, begins with a definition of this very concept (the process of systematic inquiry whose main characteristic feature is its replicability and through which data are collected, analysed, interpreted and used with the purpose of understanding, describing, predicting or explaining the issue under investigation). It then goes on to deal with the central features here: the selection of the topic area, the theoretical framework adopted, the stating of objectives and hypotheses, the choice of variables (nominal, ordinal, interval), the selection of participants in the sample, data analysis and presentation and, finally, the question of research validity and its types (internal, external, construct validity, etc.).

Chapter 2 introduces the main types of research design and the classification of statistical techniques. An initial distinction is made between quantitative and qualitative research, to be used later on to deal with corresponding subtypes. A wide variety of statistical techniques are also included, according to the nature and number of variables considered. Thus we may use single variable techniques, techniques to draw connections between quantitative variables, and techniques to make comparisons between groups, etc. The chapter concludes with an appendix showing a taxonomy of the most common statistical techniques and five tables summarising the most relevant parametric and non-parametric tests for the comparison of groups and for the analysis of relations between quantitative variables.

The organisation and presentation of data are central to Chapter 3. Questions such as the definition of a variable in a statistical programme, the entering of data, the coding of the replies obtained, the identification of errors and the distribution of frequencies are discussed here at length.

Chapter 4 focuses on the description of some basic concepts in statistics: mode, median, mean, weighted mean, range, mean deviation (MD), variance, standard deviation, standard scores, variation coefficient, normal distribution and interpretation of the standard level of a test.

Statistical inference, defined as the process of drawing conclusions from data subject to random variation, is the topic area of Chapter 5. A preliminary distinction is made between parametric and non-parametric inference, and the authors go on to explain how we can come up with criteria to reject the null hypothesis; the effects of the statistical potential and the size of the sample on findings are then discussed.

Chapter 6 concentrates entirely on the study of the different types of parametric tests: the contrast of two means in independent samples, student t distribution for independent samples and how we can obtain the t value with statistical packages and without them, the contrast of two means in related samples, the contrast of proportions in independent samples, the contrast of proportions in related samples and precautions that should be taken to interpret the results of a significance test.

Chapter 7 presents a thorough analysis of the contingency tables for categorical variables. Contingency tables generally provide information on the distribution of general, marginal and conditional frequencies. The Pearson  $X^2$  test is the statistical tool most widely used in applied linguistics when operating with categorical variables, since it allows us to accept or reject the hypothesis of interdependence between the variables contrasted.

If Chapter 7 concentrates on parametric tests, Chapter 8 does the same with non-parametric tests. The analysis of variance (ANOVA) is then analysed in detail in Chapter 9, which starts by considering the foundations of this test and goes on to consider the analysis of ANOVA using the SPSS application, as well as how to deal with multiple comparisons and contrasts. This chapter concludes with an explanation of factorial designs.

The notion of correlation and its calculation are central issues in Chapter 10, which first deals with the Pearson lineal correlation coefficient and its calculation using either SPSS or a simple calculator, and then examines non-parametric correlations based on ranks. Once again the two options are given, SPSS or a calculator. The final chapter in the book deals with lineal regression analysis, making a distinction between the simple and the complex modalities. Attention is also paid to how to present findings when using these methods.

For future editions of this work, a number of small improvements could be made. Firstly, although the title leads us to expect that most areas in language research will be dealt with, the emphasis is here clearly on applied linguistics and, more particularly, on second language learning and teaching; there is very little, for example, on statistical designs and techniques which are typical of the sociolinguistic field. Secondly, the activities proposed at the end of each chapter are not always very creative, differing in nature and number from one chapter to another. Thirdly, whereas the definitions in the glossary at the end of the volume are very useful and practical, it would be a good idea to provide examples of them in use, where this is possible. Fourthly, the number of websites suggested in the appendix is quite limited and it could easily be expanded. Finally, it would also be useful to have a function index at the end, indicating where information about each of the entries listed can be found in the book.

As mentioned above, this book constitutes a very good introduction to linguistic scientific research. It will not solve all our problems in the field, since it will be necessary to adopt a hands-on approach and do our own statistical analyses in order to move more deeply into language research. However, having this book at hand will definitely be of considerable help.

## References

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