form an additional illocutionary act. For deontics, P builds on Lewis 1979 and Ninan 2005, and proposes that this illocutionary act is the issue of a command to the speaker's addressee, namely to bring about the state of affairs expressed by the complement clause. A deontic claim does not always merely place an obligation on its subject, contrary to what was originally thought in the syntactic literature. Thus, while *Mary must brush her teeth* is usually understood as reporting an obligation of Mary's, it does not need to, as in the case where Mary is a small child, and the sentence is used as an instruction to her babysitter. This fact is captured straightforwardly via this additional command to the addressee. Finally, for abilities, P suggests that actuality entailments may be the result of an additional illocutionary act of assertion, namely the assertion of the complement clause itself. A few questions arise with such a strategy. In particular, for actuality entailments, why should the additional assertion be triggered (or inhibited) by perfective/imperfective aspect? More generally, P proposes that the performative dimension is part of the conventional meaning of each modal. This solution allows all modals to share a similar semantics (in terms of quantification over possible worlds). Unlike in Kratzer's theory, however, it requires that each modal type have its own lexical entry with its own conventional meaning (e.g. epistemic *may*, deontic *may*), leaving open the question of why it is that, in language after language, these various types of modality are often expressed by the same words. While many issues remain open, however, P's ideas present new and exciting avenues to explore, and will no doubt be refined in later work by him and others.

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Statistics in language research: Analysis of variance. By TONI RIETVELD and ROELAND VAN HOUT. Berlin: Mouton de Gruyter, 2005. Pp. vii, 265. ISBN 9783110185812. $39.

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The use of parametric statistics—especially analysis of variance (ANOVA) and linear regression—has played an essential role in language research in a number of disciplinary areas for decades, including psycholinguistics and phonetics. There has been a significant increase, however, in the use of such analytic techniques in other areas of linguistics as well, including syntax, semantics, sociolinguistics, and dialectology. The need for these analytic methods often arises

whenever the researcher is analyzing language data (whether collected through surveys, in experiments, in field studies, or in language corpora). The authors' goals are to provide a comprehensive description of ANOVA and instructions for organizing the data, to conduct analyses in the Statistical Package for the Social Sciences (SPSS), and to interpret the results. This book is designed for students (and researchers) who already have a solid background in basic descriptive and inferential statistics, but who want to develop extended skills in the use of ANOVA techniques; knowledge of basic precalculus mathematics is expected. The authors are well known in their respective fields and extremely well qualified to write this book. Toni Rietveld has numerous publications related to analytic methodologies and statistical treatment of language data, and Roeland van Hout studies language variation in the Dutch language area, including dialect lexicography (and analysis of language corpora) and dialectology.

The organization of the book is quite straightforward and easy to follow. Each chapter is devoted to a reasonably narrow topic and divided into separate sections, each of which builds upon concepts developed earlier. Included with all presentations of material are illustrative examples related to various aspects of language research—a welcome change from standard textbooks on statistics in which examples are often drawn from the social sciences or agriculture. Each chapter has a 'preview' section that outlines what will be covered, the content sections, and a section on 'terms and concepts' that provides concise definitions of the most important and relevant terms used in the chapter. At the end of each chapter there is a set of exercises that tests the knowledge gained by the reader, and answers to all exercises appear in an appendix at the end of the book.

Ch. 1, 'Language research and statistics' (1–12), is the most elementary chapter in the book and is designed to provide readers with a review of concepts like the nature of data analysis, independent and dependent variables, participants, measurement scales, experimental designs, and between- vs. within-subject factors. The authors have also outlined the specific data formats used in SPSS for these research designs. Anyone who has taught statistics using SPSS (or actually any other statistical package) will appreciate how difficult it is to ensure that students have organized their input data in the proper format in order to successfully complete the analyses they want to perform. Therefore, providing these examples is an especially welcome addition.

Ch. 2, 'Basic statistical procedures: One sample' (13–30), and Ch. 3, 'Basic statistical procedures: Two samples' (31–48), review basic inferential statistical procedures. They cover the material quickly (in only thirty-seven pages), but the topics include some of those most important to the understanding of hypothesis testing, research design, data analysis, and the interpretation of test results, such as sampling variability (e.g. sampling distribution, standard error, and the sample distribution of the means), Type I (α) and II (β) errors, statistical power ($1 - \beta$), sample size, and simple t-tests and z-tests (the former will become important when completing post hoc analyses after a significant effect is found in the ANOVA analysis). R&H also give a very readable discussion about how to determine the size of the sample that will be needed in order to achieve a given level of statistical power in an inferential test. This is useful when presenting a rationale to the local Human Subject Review Board for why N participants are needed for a study.

Ch. 4, 'Principles of analysis of variance' (49–73), describes the principles of ANOVA in light of the most elementary research design: a one-way ANOVA with a between-subject factor. The first topic covered is the 'model equation' of the sources of variability in each observed score (the model that serves as the basis for a simple one-way ANOVA). Included in this description is the 'partitioning of the sums of squares' in a manner similar to that found in most basic statistics texts (e.g. Hays 1981, Gravetter & Wallnau 2009). Here (and throughout the book) R&H describe how to run the ANOVA in SPSS using both the pull-down menu and in syntax mode. Providing instructions in terms of how to use the syntax model in SPSS (which was the original format) is very useful in that some statistical analyses cannot be done using the pull-down menu. Following the presentation of the one-way ANOVA, R&H show the general approach to post hoc comparisons when the 'global hypothesis'—that all effects or levels of the factor are null—is rejected. Although they list eighteen potential post hoc tests, they only provide an illustrative example of one (the Tukey HSD test). Finally, they give suggestions about the format for reporting the statistics obtained.

In Ch. 5, 'Multifactorial designs' (75–107), R&H expand the view of ANOVA to multifactorial designs with both random- and fixed-effects factors, using both repeated-measures and hierarchical designs. Of course, here they expand the simple model equation to include not only a second factor (or effect), but also an interaction term. The authors make every effort to provide a mathematical description of the model but are careful to make it understandable to the less technical reader. They also include an excellent discussion of what a significant interaction might mean and/or represent, noting that it is often the interaction effect that is more significant (and relevant) to the analysis than any of the significant main effects. Ch. 6, 'Additional tests and indices in analysis of variance' (109–24), follows with a description and discussion of additional post hoc tests of both main and interaction effects, including pair-wise comparisons and contrast analysis. R&H give a very clear presentation of the importance of evaluating both effect size and the strength of association of a significant result rather than the size of the *p* value. Consideration of effect size has often been missing and unreported in language research literature, although many journals (e.g. *Journal of the Acoustical Society of America*, *Journal of Speech, Language and Hearing Research*, and most psychology journals) now require such statistics to be provided.

All parametric statistical tests are based on sets of underlying assumptions that determine, to a large extent, the validity of results as well as subsequent interpretations and conclusions. Ch. 7, 'Violations of assumptions in factorial designs and unbalanced designs' (125–50), examines the nature of the underlying assumptions for ANOVA, the consequences of violations of these assumptions (and how robust ANOVA is to such violations), and ways to mitigate them. The assumptions in ANOVA include (i) the normality assumption, (ii) the homogeneity of variance, and (iii) independence. R&H consider tests for violations (e.g. Levene's test) and give a thorough discussion of the value and importance of—and constraints on—data transformation, both linear and nonlinear, to avoid problems such as nonhomogeneity of variance. They insightfully discuss the problems of unbalanced research designs, which constitute a common problem in psycholinguistic research when the number of participants or responses in different cells of the data set are unequal.

Ch. 8, 'Repeated measures designs' (151–86), addresses the use of repeated-measures designs, almost certainly the most utilized design in language research: that is, responses from individual participants are obtained in different experiment conditions or at scheduled intervals over a period of time. As R&H point out, however, 'the analysis of data obtained in repeated measures designs is not straight-forward' (151). The authors show how the analysis separates between-subject variation from within-subject variation (and error terms), and discuss the computation of the significance test (the various *F*-tests). They introduce a very readable section on evaluation of the sphericity condition—a type of homogeneity-of-variance condition in repeated-measures designs—and adjustments in the significance tests when there are violations of sphericity. It is in this chapter that the authors address one of the most (in)famous problems in the analysis of language data, especially psycholinguistic data: the so-called 'language-as-fixed-effect fallacy' from Clark 1973. This article generated controversy at the time about how to appropriately analyze language data (e.g. Wike & Church 1976), and the concerns raised by Clark continue to reverberate into the present (see the discussions in Raaijmakers et al. 1999, Forster & Masson 2008). At issue is whether certain factors (e.g. 'words') can or should be considered a fixed effect rather than a random effect—the decision has a very significant impact on the nature of the analysis conducted. R&H give a short but useful discussion of the computation and use (as well as limitations) of various alternative *F*-ratios including the quasi *F* ratio (F') and min F'. They also outline both univariate and multivariate approaches to the analysis of repeated-measures designs. In Ch. 9, 'Alternative estimation procedures and missing data' (187–209), R&H describe maximum likelihood estimation (a variation on estimating variance components) and show how to address the problem of missing data. This is one of the densest chapters in the book and, I believe, will be the hardest for a reader to follow.

The final chapter, Ch. 10, 'Alternatives to analysis of variance' (211–31), outlines three different alternatives to ANOVA techniques discussed earlier: randomization tests, boot-strapping, and multilevel analysis. It is the final analytic technique (multilevel modeling or fixed/mixed-effects analysis) that is the most important of the three described and is now entering the arena of speech research, having gained considerable momentum in social science research. This technique ap-

proaches the data analysis by using various regression models and looking at both the resulting slopes and the y-intercepts. The chapter, however, will only whet the appetite of readers for this type of analysis; interested readers would be advised to consult much longer descriptions of fixed/mixed-effects analysis, such as Quené & van den Bergh 2004, 2008.

There are many features to commend in this book. Although the content is relatively dense, it is quite readable, maintaining an appropriate tone. Both the use and abuse of ANOVA that a researcher needs to understand is presented in great detail; the instructions for various statistics in SPSS, as well as sample SPSS outputs for almost every analysis and their explanations, are equally valuable. One serious complaint about the book might be that since many researchers may use statistical packages other than SPSS, such as SAS or R (a program used by a growing number of linguists), the explicit guidelines regarding use of SPSS will not be useful. However, the description of the nature of the main and interaction effects, especially with regard to the expected values of the various mean-square values and the appropriate error terms, should still be of use to those using other statistical programs.

In conclusion, this book is a valuable resource for language researchers. It provides an in-depth understanding of the use of ANOVA for both univariate and multivariate analysis, and serves as a readable reference for questions about research design, SPSS syntax, and interpretation of results. Given the nature of the examples and the framework, the book can also be used as a helpful and appropriate textbook for a more advanced graduate-level course on statistical analysis in linguistics, psycholinguistics, or related disciplines like the speech and hearing sciences.

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Computational approaches to morphology and syntax. By BRIAN ROARK and RICHARD SPROAT. (Oxford surveys in syntax and morphology 4.) Oxford: Oxford University Press, 2007. Pp. xx, 316. ISBN 9780199274789. $55.

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Computational approaches to morphology and syntax provides an overview of the fields of computational morphology and syntax (i.e. parsing), covering both classic techniques and the