

Why quantitative?¹

DAVID EDDINGTON

1. Introduction

It is generally the case that special volumes include studies on a narrowly defined topic of linguistic investigation from a single theoretical standpoint. A glance at the table of contents of the present issue, on the other hand, reveals an eclectic group of papers with topics ranging from second-language acquisition to feature theory. In addition to the variety of topics covered, it should be noted that a wide variety of theoretical frameworks is represented. The present volume contains the work of researchers who assume structuralist, generative, functionalist, and psycholinguistic perspectives. Nevertheless, the thread that ties these studies together is that they investigate some aspect of the Spanish language and utilize quantitative methods. A volume containing studies of Spanish is not unusual, but the emphasis on quantitative approaches may strike some as odd and elicit the question, "why quantitative?" What I would like to suggest is that there are essentially three reasons for conducting quantitative research: (1) quantifying a particular question forces one to consider a wide range of data, which in turn makes the analysis more reliable; (2) data from quantitative studies are a crucial part of testing empirical hypotheses; (3) quantitative studies are in a better position to reflect facts about how people actually use language than are analyses that do not utilize quantitative data.

2. Data-based theories

If one were to take a random sample of articles from the linguistic literature and count up the average number of words/forms/utterances that are used by the author to support his/her theory, the number would no doubt be small. It should be obvious that basing a theory on a handful of examples (often gleaned from the investigator's own psyche) is methodologically suspect, yet this is precisely the sort of narrow evidence that is often presented in linguistic analyses. Of course, the danger with this approach is that one is often predisposed to find a handful of

examples that affirm one's theory, and to overlook (either unconsciously or consciously) any counterexamples.

Morin (1999) provides an example of how a data-oriented approach can lead to a reevaluation of the conclusions of a data-poor analysis. She examined the criteria proposed to distinguish between Spanish words that contain word markers, and those that do not. After careful consideration of a large number of Spanish words, she found that the criteria simply do not hold up when a much larger number of examples is considered. In a similar vein, Eddington (1996a) found that the relationship between certain derivational suffixes and diphthongization in Spanish word stems is far from binary as previous investigation had considered it to be. This only becomes apparent when a large number of examples are taken into consideration.

In the present volume, three researchers make use of corpora. De Mello reports a study of a large corpus of spoken Spanish from Latin American. Anecdotal evidence suggests that *leísmo* (the use of the indirect object pronoun *le* for direct objects) still exists in American Spanish. However, De Mello's findings cast doubt on the continuing existence of *leísmo* in those dialects. Torres Cacoullos's contribution focuses on the pronoun *le* as well. She studies the rise of *le* as a verbal intensifier in Mexican Spanish by measuring the relative frequency of the contexts of occurrence of *le* in historical documents. The death of *leísmo* may have opened the door for *le* to gain a new function as a verbal intensifier. Hualde and Prieto report on a study in which they gathered new data from linguistically naive speakers as part of an ongoing study of diphthong/hiatus contrasts. This type of data gathering is important since it avoids the problems of validity that arise when researchers consider their own intuitions as representative of all other speakers of the language.

In some areas of linguistic investigation, advances in technology allow researchers to gather quantities of data that were simply unavailable in the past. The recent boom in corpus analyses is fueled by the ever-increasing speed of computers, as well as the availability of digitized corpora. For example, Eddington's computer simulation of diminutive formation would have been impossible to carry out fifteen years ago. In like manner, Willis's and Face's contributions required the use of modern speech-analysis programs. Willis found that no unique intonational factors are consistently associated with imperative phrases when contrasted with declarative phrases, although some tendencies exist. Face demonstrates that the relationship between the two tones of one bitonal pitch accent may be stronger or weaker than the relationship between the tones of another and argues that a hierarchical pitch-accent structure is able to account for this finding.

3. Empirical and nonempirical theories

The scientific method essentially involves stating a hypothesis and then presenting evidence that corroborates or falsifies the hypothesis. Karl Popper (1968) is credited with distinguishing between empirical and nonempirical realms of scientific enquiry. According to him, empirical theories are those that are stated in such a way that they are subject to being potentially falsified. In addition, empirical theories must relate to events, processes, or activities that take place in time and space. This means that empirical theories must be subject to possible falsification on the basis of spatiotemporal evidence (see also Itkonen 1976a, 1978). The purpose of quantitative methods is to capture and measure spatiotemporal events (e.g. utterances, reaction times, speaker preferences) in the hopes of obtaining data that will support or refute a specific hypothesis.

If potential spatiotemporal falsifiability is the hallmark of an empirical theory, is there such thing as a nonempirical theory? Yes, fields such as philosophy, pure mathematics, and formal logic all deal with theories of entities that do not have spatiotemporal manifestations and are not readily quantifiable. By the same token, much of what is done under the rubric of theoretical or formal linguistics must also belong to the nonempirical side of the coin (Botha 1971, 1973; Derwing 1973; Eddington 1996b; Hall 1987; Itkonen 1976a, 1978, 1983; Katz 1981, 1985; Katz and Postal 1991; Lass 1976a; Ringen 1975; Steinberg 1975; Yngve 1986).²

This is not to say that nonempirical theories of language are not useful. The knowledge of what structures exist in a language is a prerequisite for determining if or how those structures play a part in speech perception and production.

A number of contributions to this volume utilize quantitative methods to study the role of certain formal entities in language cognition. By means of a perception experiment, Marks, Moates, Bond, and Stockmal ask if the feature [sonorant] is involved in word recognition. Geeslin, for her part, attempts to determine whether the notion of semantic transparency is a relevant factor in copula choice for second-language learners. In a priming study, Domínguez, Segui, and Cuetos investigate whether the concept of morpheme is conceptually distinct from orthographic and semantic factors, or whether it merely emerges as a confluence of the two.

Quantitative studies of linguistics are valuable in empirical hypothesis testing in that they involve measuring spatiotemporal manifestations of language. Of course, one may always claim that quantitative

analyses relate to performance, while many linguistic analyses claim relevance only to competence. The distinction between competence and performance (Chomsky 1980a) is a sticky one for a number of reasons. First, it is difficult to tease the two apart since any utterance necessarily reflects underlying knowledge along with production factors. That is, there is no such thing as pure competence unfettered by performance factors (Stemberger 1994; Wheeler 1980; Zimmer 1969). Second, the study of competence is the study of the innate linguistic knowledge that is assumed to be possessed by an ideal speaker-hearer. Performance, on the other hand, examines how actual speakers process linguistic information.

What constitutes the grammar of an ideal speaker-hearer is a valid realm of inquiry (Carr 1990, 2000; Katz 1981, 1985; Katz and Postal 1991). However, the difficulty is that researchers often attribute the same characteristics they assume an ideal speaker-hearer has to actual speaker-hearers; many also use performance-related data to justify models of competence and vice-versa (Stemberger 1996). An example of this sort of confusion may be seen in Chomsky's writings. On the one hand, he claims that generative grammar is a theory of abstract linguistic entities. At the same time, he assumes that generative linguistics is the empirical study of human cognitive abilities (Katz 1985; Katz and Postal 1991; Olshewsky 1985). Although both empirical and nonempirical studies are valid approaches to the study of language, it is necessary to draw a distinct boundary between the two (Itkonen 1976b; Prideaux 1971). Failure to keep the two approaches apart ultimately leads to drawing invalid conclusions (Yngve 1986). Therefore, carefully constructed quantitative research should utilize data that allow an empirical hypothesis to be tested. To the extent that it does, it is empirical research that may mirror more closely the linguistic abilities of actual speakers (in contrast to idealized ones).

4. Psychological validity

The issue of empirical hypothesis testing and the psychological validity of a linguistic analysis are intimately related. Many researchers who are interested in actual language processing turn to quantitative methods. Why? Because the ability to quantify the spatiotemporal phenomena predicted by a theory, and the probability that the theory represents some aspect of linguistic cognition, are intimately related. Nonempirical studies of language have been extremely successful in discovering the structures, patterns, and generalizations to be found in languages. Since

languages are produced by humans, it is possible that humans have knowledge of or utilize these structures during linguistic processing. However, the mere existence of a linguistic structure does not necessarily mean that it plays a part in processing, only that it is available to be potentially known or utilized. In order to determine what is actually known and used, research must be directed toward the speakers themselves, rather than be carried out as if a language were completely separate from the people that speak it (Derwing 1980). It has also been argued (e.g. Bybee 2001) that linguistic structures, as well as knowledge of linguistic structures, emerge from language use. Therefore, quantifying language use should yield insights into questions of what structures exist and how these are represented in the minds of speakers.

What I would like to suggest is that there are linguistic realities and psychological realities. A detailed, rigorous, or sophisticated description of a linguistic phenomenon in a given framework may describe a linguistic reality without describing a psychological one (Botha 1971; Derwing et al. 1980; Goyvaerts 1978; Harmon 1980; Lass 1976b; Morin 1988). Or as Chomsky puts it, "there is a question of physical (or psychological) reality apart from truth in a certain domain ..." (1980b: 45). Confusion between linguistic and psychological realities is often created when linguists speak of constraints, rules, or underlying representations as if they represented psychological processes, when in reality they do not mean to do so. This practice inadvertently leads to elevating a linguistic description to the level of a psychological explanation, or referring to an analysis as psychologically valid when what is actually meant is linguistically valid (Black and Chiat 1981). Quantitative data is an important part of building a psychologically valid theory because a theory that can be proved or disproved on the basis of spatiotemporal events possesses a sense of tangibility and concreteness since real events take place in time and across space. The same sense of tangibility is missing in a theory that involves no spatiotemporal manifestations, or that eludes possible falsification.

The goal of every quantitative study of a linguistic phenomenon is not necessarily to gain insight into psychological mechanisms. However, several contributions are oriented in that direction, such as the above-mentioned priming study by Domínguez et al. Although Eddington's computer simulation does not involve a psycholinguistic probe of native speakers, it does demonstrate that a morphophonological process such as diminutive formation may be accounted for in terms of storage of exemplars and analogy to those stored exemplars. Barkanyi's experiment, on the other hand, involved native speakers more directly. She asked Spanish speakers to indicate stress on nonce words and judge the acceptability of prestressed nonce words. Her results indicate that stress

is marked lexically, rather than being rule-derived. Moreover, stress placement was not shown to be sensitive to syllable weight.

5. Conclusion

Although the studies in this volume deal with a wide range of phenomena from a number of different perspectives, they are unified in that they strive to base their findings on quantifiable data. I have argued that quantitative research is an important part of linguistic theorizing, and that it plays an essential role in empirical hypothesis testing, especially in testing hypotheses regarding human linguistic cognition.

University of New Mexico

Notes

1. Correspondence address: Ortega Hall 235, University of New Mexico, Albuquerque, NM 87131, USA. E-mail: davee@unm.edu.
2. Carr (1990, 2000) claims that linguistics is empirical in spite of the fact that it deals in hypotheses that are not potentially falsifiable on spatiotemporal grounds. This position is extremely controversial (see Love 1992) and if presented outside the field of linguistics would most likely be flatly rejected.

References

- Black, Maria; and Chiat, Shulamuth (1981). Psycholinguistics without "psychological reality." *Linguistics* 19, 37–61.
- Botha, Rudolf P. (1971). *Methodological Aspects of Transformational Generative Phonology*. The Hague: Mouton.
- Bybee, Joan (1973). *The Justification of Linguistic Hypotheses*. The Hague: Mouton.
- (2001). *Phonology and Language Use*. Cambridge: Cambridge University Press.
- Carr, Philip (1990). *Linguistic Realities: An Autonomist Metatheory for the Generative Enterprise*. Cambridge: Cambridge University Press.
- (2000). Scientific realism, sociophonetic variation, and innate endowments in phonology. In *Phonological Knowledge*, Noel Burton-Roberts, Philip Carr, and Gerard Docherty (eds.), 67–104. Oxford: Oxford University Press.
- Chomsky, Noam (1980a). *Rules and Representations*. New York: Columbia University Press.
- (1980b). Rules and representations. *Behavioral and Brain Sciences* 3, 1–15, 42–61.
- Derwing, Bruce L. (1973). *Transformational Grammar as a Theory of Language Acquisition*. London: Cambridge University Press.
- (1980). Against autonomous linguistics. In *Evidence and Argumentation in Linguistics*, Thomas A. Perry (ed.), 163–189. Berlin: Walter de Gruyter.
- ; Prideaux, G. D.; and Baker, W. J. (1980). Experimental linguistics in historical perspective. In *Experimental Linguistics*, Gary D. Prideaux, Bruce L. Derwing, and William J. Baker (eds.), 1–13. Ghent: Story-Scientia.
- Eddington, David (1996a). Diphthongization in Spanish derivational morphology: an empirical investigation. *Hispanic Linguistics* 8, 1–35.
- (1996b). The psychological status of phonological analyses. *Linguistica* 36, 17–36.
- Goyvaerts, Didier L. (1978). From triumphant euphoria to bitter disappointment? *Communication and Cognition* 11, 287–307.
- Hall, Robert A., Jr. (1987). *Linguistics and Pseudo-Linguistics*. Amsterdam: Benjamins. (Originally printed [1981–1982]. Review of Newmeyer, *Linguistic Theory in America*. *Forum Linguisticum* 6, 177–188; and [1973]. *Journal of English Linguistics* 7, 21–42.)
- Harmon, Gilbert (1980). Two quibbles about analyticity and psychological reality. *Behavioral and Brain Sciences* 3, 21–22.
- Itkonen, Esa (1976a). *Linguistics and Empiricalness: Answers to Criticisms*. Helsinki: University of Helsinki.
- (1976b). The use and misuse of the principle of axiomatics in linguistics. *Lingua* 38, 185–220.
- (1978). Linguistics: nonempirical and empirical. In *Proceedings of the 12th International Congress of Linguists*, Wolfgang U. Dressler and Wolfgang Meid (eds.), 157–158. Innsbruck: University of Innsbruck.
- (1983). *Causality in Linguistic Theory*. London: Croom Helm.
- Katz, Jerrold J. (1981). *Language and Other Abstract Objects*. Totowa, NJ: Rowman and Littlefield.
- (1985). An outline of platonist grammar. In *The Philosophy of Linguistics*, Jerrold J. Katz (ed.), 172–203. Oxford: Oxford University Press.
- ; and Postal, Paul M. (1991). Realism vs. conceptualism in linguistics. *Linguistics and Philosophy* 14, 515–554.
- Lass, Roger (1976a). *English Phonology and Phonological Theory*. London: Cambridge University Press.
- (1976b). On generative taxonomy and whether formalisms "explain." *Studia Linguistica* 30, 139–154.
- Love, Nigel (1992). Review of *Linguistic Realities*, by Philip Carr. *Language and Communication* 12, 79–92.
- Morin, Regina (1999). Spanish substantives: how many classes? *Advances in Hispanic Linguistics*, Javier Gutiérrez-Rexach and Fernando Martínez-Gil (eds.), 214–230. Somerville, MA: Cascadilla.
- Morin, Yves-Charles (1988). Morphological conditioning in phonologically transparent processes: evidence from the evolution of vowel reduction in Vinzelles Occitan. *Canadian Journal of Linguistics* 33, 431–442.
- Olshevsky, Thomas (1985). Chomsky's realism. *Proteus* 2, 19–25.
- Popper, Karl R. (1968). *The Logic of Scientific Discovery*, 2nd ed. New York: Harper and Row. (Original English edition [1959]. London: Hutchinson.)
- Prideaux, Gary (1971). On the notion "linguistically significant generalization." *Lingua* 26, 337–347.
- Ringen, Jon D. (1975). Linguistic facts: a study of the empirical scientific status of transformational generative grammars. In *Testing Linguistic Hypotheses*, David Cohen and Jessica R. Wirth (eds.), 1–42. Washington, D.C.: Hemisphere.
- Steinberg, Danny D. (1975). Chomsky: from formalism to mentalism and psychological invalidity. *Glossa* 9, 218–252.

- Stemberger, Joseph Paul (1994). Rule-less morphology at the phonology–lexicon interface. In *The Reality of Linguistic Rules*, Susan D. Lima, Roberta L. Corrigan, and Gregory K. Iverson (eds.), 147–169. Amsterdam: Benjamins.
- (1996). The scope of the theory: where does “beyond” lie? In *Proceedings of the Parasession of the Chicago Linguistic Society’s 32nd Meeting*, Lisa McNair, Kora Singer, Lise M. Dobrin, and Michelle M. Aucoin (eds.), 139–164. Chicago: Chicago Linguistic Society.
- Wheeler, Cathy J. (1980). On the relationship between phonology and psychology. *Papers in Linguistics* 13, 51–100.
- Yngve, Victor H. (1986). *Linguistics as a Science*. Bloomington and Indianapolis: Indiana University Press.
- Zimmer, Karl E. (1969). Psychological correlates of some Turkish morpheme structure conditions. *Language* 45, 309–321.