REFIGURING ANTHROPOLOGY

First Principles Of Probability & Statistics

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1 Statistics in Anthropology

● *The fact that for a long time Cubism has not been understood and that even today (circa 1930) there are people who cannot see anything in it means nothing. I do not read English; an English book is a blank book to me. This does not mean that the English language does not exist. Why should I blame anyone but myself if I cannot understand what I know nothing about?*—P. Picasso

Introductory statistics texts generally begin by attempting to convince the reader that a thorough knowledge of statistics is almost imperative for survival in modern society. Without an elementary statistical awareness, one is incapable of appreciating, for example, the extraordinary predictability of baseball batting averages, the economic merit of industrial quality control, or even the findings of the now-familiar Harris and Gallup polls, which monitor (and modify) current political and social trends. A more philosophical perspective suggests that better Science — and hence a general betterment of mankind — can result only from the more rigid and insightful application of statistical thinking.

There are likewise a number of forceful justifications to encourage a basic understanding of statistics for the anthropologist. Unfortunately, these justifications assume working knowledge of statistical procedures; and if you knew enough statistics to appreciate the justification, you would not need this book. So, the only point of this initial chapter is to demonstrate the simple, pragmatic fact that anthropology is rapidly becoming a quantitative discipline and that without an appreciation of elementary quantitative methods the student will be left behind.

Let us consider, for example, current practices in teaching anthropology. Despite an obvious educational trend away from rigid requirements, many graduate programs in anthropology have recently been significantly modified to

prepare students to cope with the increasingly quantitative methods in anthropology. In 1974 over half (52.6 percent) of the graduate departments of anthropology in the United States and Canada required (or at least strongly recommended) of their Ph.D. candidates a basic acquaintance with the fundamentals of statistics. In fact, a number of graduate programs encouraged the student to substitute a statistical proficiency for the time-honored foreign language requirement. Also in 1974, nearly 30 percent of the master's degree candidates in anthropology were required to demonstrate a familiarity with common statistical concepts and practices. There are even forward-looking undergraduate programs in anthropology which require statistics of their undergraduate majors, and it seems probable that many of the students now using this book have been coerced to do so by curriculum requirements.[1]

In short, a working knowledge of statistical inference and cognate testing procedures has become virtually essential for anybody wishing to deal with anthropological data and to truly comprehend the findings of up-to-date anthropology. To those who disagree with this position, I offer the professional literature itself.

Scholarly journals not only serve to disseminate the research results of practitioners of the profession, but also function as lasting archives in which the very development of a discipline is recorded. As such, professional journals undoubtedly provide the single, best barometer of significant trends and patterns within a discipline. It seems clear that within the past two decades there has been a notable increase in the application of statistical thinking brought to bear on anthropological problems. To illustrate this point, I conducted a simple survey in which a major journal was selected from each subfield of anthropology. These journals were then evaluated with respect to their dependence upon statistical procedures: The *American Journal of Physical Anthropology* (the official journal of the American Association of Physical Anthropology) was selected as representative of physical anthropology; *American Antiquity* (the official journal for the Society for American Archaeology) was chosen to reflect American archaeology; *Language* (vehicle of the Linguistic Society of America) was selected to represent anthropological linguistics; the *American Anthropologist* was included to represent not only ethnology but also anthropological theory in general. Each periodical was selected because of its long-range perspective and its generally unbiased coverage of the respective subdiscipline. The total run of each journal was analyzed. Each of the 7903 articles was examined to determine whether the author had relied upon statistical inference in his research.[2]

Just how important has statistical reasoning been in the development of today's anthropology? Figure 1.1 illustrates the findings of this survey and answers this question. We note immediately that physical anthropology has relied upon statistical inference to a much greater degree than any other

[1]These figures were derived from the *Guide to Departments of Anthropology 1973–74*, published by the American Anthropological Association, in which 134 graduate departments described their own programs and degree requirements.

[2]"Statistical inference" means using known principles of probability theory to derive sensible conclusions about an entire population, based upon a small sample from that population. This concept, the very bulwark of statistical reasoning, is explored in greater detail in Chapter 2.

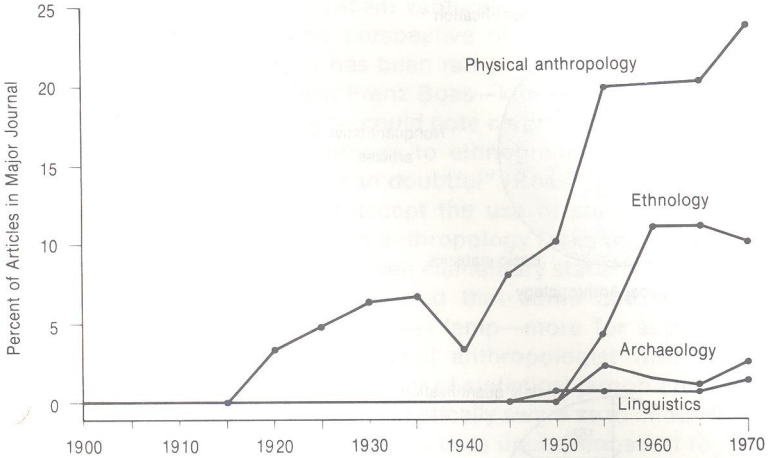

Fig. 1.1 The use of *statistical inference* in anthropology since 1900.

subfield of anthropology. In fact, statistical inference became a common research tool for physical anthropologists a full three decades before its consistent application to ethnology and archaeology.[3] Even more striking is the overall trend in quantification: The use of statistical inference has been markedly increasing over the past two decades in *all* of anthropology (except anthropological linguistics). Beginning in the early 1950s, anthropologists have increasingly used statistical procedures as a vital tool in analyzing their field data, and this trend shows no indication of declining in the 1970s—quite to the contrary.

These findings illustrate both the increasing importance of statistical thinking in anthropology and the relative consumption of quantitative procedures by anthropology's subfields. But there are those anthropologists (and their students) who still question the overall importance of statistics to today's anthropology. To see just what is going on in modern anthropology, a recent volume (1972) of each journal was dissected in greater detail.

What proportion of the papers relies upon *simple quantification*, such as graphs, numerical tables, or codified informant responses?

What proportion relies upon *fundamental statistics* (essentially those topics covered in this book)?

What proportion includes analysis by *advanced statistics* (mainly multivariate techniques beyond the scope of this text)?

The findings of this more detailed survey are displayed on the circle graphs of Fig. 1.2.

[3]The earliest use of statistical methods in anthropology is generally ascribed to the physical anthropologist Morton, who analyzed measurements from a large series of crania in 1839. E. B. Tylor's paper, "On a Method of Investigating the Development of Institutions" (1889), in which Tylor attempted to determine evolutionary sequences by analyzing "adhesions" of social traits, is generally acknowledged to be the earliest application of statistical procedures to ethnological data (see Driver 1953:50).

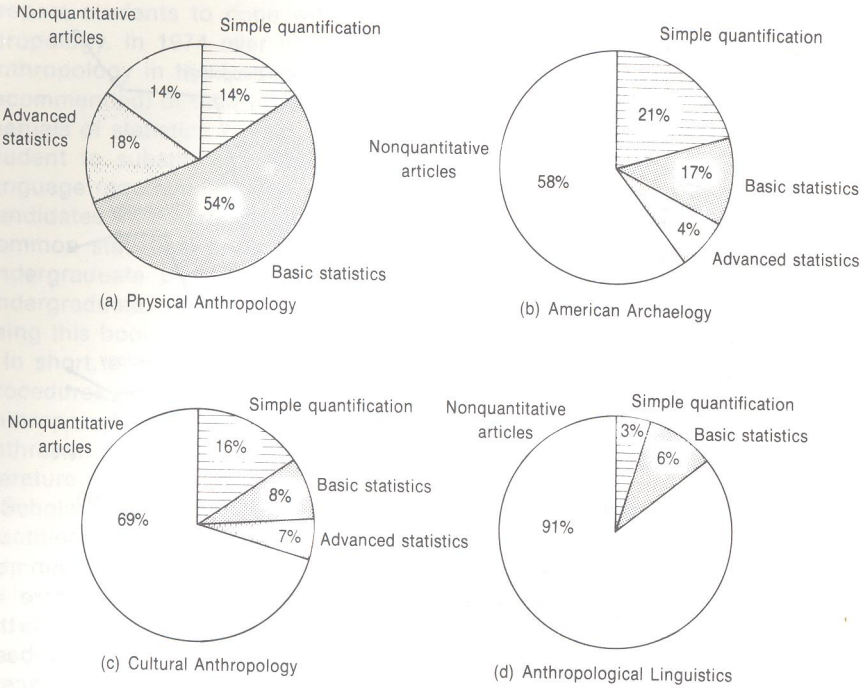

Fig. 1.2 Relative importance of quantitative and statistical analyses in modern anthropology. Source: (a) *American Journal of Physical Anthropology*, 1972; (b) *American Antiquity*, 1972; (c) *American Anthropologist*, 1972; (d) *Language*, 1972.

It is again obvious that physical anthropology remains the most quantitative, most statistically sophisticated of anthropology's subdisciplines. While this result was probably predictable from the previous survey of the literature, the actual degree of dependence upon statistical reasoning seems startling: Over 85 percent of the 1972 articles in the *American Journal of Physical Anthropology* employed at least elementary quantitative techniques. More than half of the 1972 papers assumed at least a preliminary grasp of basic statistical operations and reasoning on the part of the reader, and at least one article in six employed advanced statistical techniques. In other words, readers with a diffidence toward things quantitative could critically evaluate *fewer than one article in seven* in the modern literature of physical anthropology.

Over one-third of the articles for 1972 in modern archaeology and ethnology employed at least elementary quantitative analysis [Figs. 1.2(b) and 1.2(c)], and more than one in 25 articles utilized rather sophisticated statistical procedures. As expected, anthropological linguistics rarely turned to quantitative measures, with fewer than 10 percent of the 1972 articles using even elementary statistics. Most linguistics still proceed in purely qualitative fashion, without recourse to either mathematics or statistics.

Yet, despite this almost meteoric shift to quantification, statistical thinking in

anthropology remains a relatively recent venture—especially in ethnology and archaeology—when viewed in the perspective of the rest of the social and biological sciences. Anthropology has been rather reluctant to come about. In fact, as late as 1927, anthropologist Franz Boas—known in many circles as the "Father of American Anthropology"—could note cryptically that "attempts have been made to apply statistical methods to ethnographical phenomena. The success of these attempts is more than doubtful" (Boas 1927). Because of this reluctance on the part of many to accept the use of statistical methods on anthropological data, quantification in anthropology lacks the maturity evident in other social sciences, and errors in even elementary statistical operations are still alarmingly common. It has been said that some anthropologists use statistics much as the drunk uses a street lamp—more for support than for illumination. There is even an occasional anthropologist who attempts to disguise shoddy research under the veneer of statistical jargon and symbolism in the belief that few colleagues are so statistically aware as to check his results. Practices such as this cannot be allowed to pass unchallenged: It requires just as complete a grasp of statistical technique to judge when *not* to apply them as to know when statistics are imperative. All things considered, it seems clear that students planning a serious study of anthropology owe it to themselves to learn at least the fundamentals of quantification, if for no other reason than to properly assess the results of other anthropologists.

● *It began oddly. But could it have begun otherwise, however it began?*—P. Roth

SUGGESTIONS FOR FURTHER READING

Detailed titles and sources are given in References at the end of the text.

General

Driver (1953). Considers historical development of statistical methods in anthropology; separate discussions dealing with physical anthropology, archaeology, ethnology, and social anthropology.

Kay (1971). A brief discussion of the *who, what, when, where, how,* and *why* of mathematics in anthropology. Kay suggests that the major themes in mathematical anthropology are (roughly in order of importance): (1) abstract algebra, (2) computing technology, and (3) probability and statistics, with deemphasis on correlational methods and tests of significance.

Spaulding (1960). Interesting paper considering uses of statistics for archaeological description and classification. The discussion of this paper by several archaeologists is particularly enlightening, as it indicates the status of statistical thinking in the archaeology of the mid-1950s.

White (1973). A general introduction to use of mathematics in the analysis of ethnographic data; White's emphasis is largely upon probabilistic statements rather than upon conventional statistical inference.

Modern Mathematical Anthropology

Buchler and Selby (1968). An introduction to traditional and mathematical approaches to kinship and social organization.

Clarke (1972). An edited volume of papers using various models (mathematical and otherwise) in archaeological research.

Cohen and Naroll (1970). Discussion of need for comparative approaches in anthropology and the importance of quantitative methodology to the comparative approach.

Hodson, Kendall, and Tăutu (1971). Fifty-two papers presenting substantive applications of mathematical models to archaeology and the historical sciences in general.

Hoffman (1970). General review of literature and trends in mathematical anthropology.

Kemeny and Snell (1972). The authors present a number of mathematical models dealing with preference ranking, ecology, marketing systems, and problems of scheduling; not for those afraid of mathematical symbolism.

Anthropology and the Computer

Burton (1970). Paper summarizes several major projects in which computers are used to analyze uniquely anthropological data.

Hymes (1965). A compendium of 18 papers discussing statistical applications to anthropology; volume particularly strong on approaches to anthropologic linguistics.

Pelto (1970). Appendix C briefly discusses general computer nomenclature and some of the author's personal encounters with counting machines.

● *We have modified our environment so radically that we must now modify ourselves to exist in this new environment.*
—N. Weiner

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Second Printing
The 1976 version of this book was entitled *Figuring Anthropology*.

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