

# A SYSTEMATIC APPROACH TO GRAPHICAL METHODS IN BIOMETRY

M. TARTER and S. RAMAN  
UNIVERSITY OF CALIFORNIA, BERKELEY

## 1. Introduction

This paper deals with certain new graphical techniques which may be of value in exploratory biometry. In two senses, emphasis is placed upon the systematization of graphical procedures. One, a new theoretical result is obtained which gives conditions under which nonparametric histogram procedures of Parzen [11], Rosenblatt [13], Watson and Leadbetter [25], as well as others, can be treated as a special case of Fourier series methods of Cencov [2], Tarter and Kronmal [8], [19], [22], and Watson [24]. Two, by utilizing alternative weighted Fourier series, most hitherto considered graphical procedures such as the histogram, scatter diagram, and cumulative polygon are placed within a single computational framework. This systematization is shown to provide a researcher with both a comprehensive as well as a statistically and computationally efficient approach to graphical data analysis.

In Section 6 of this paper, an example of the graphical display of biomedical data is presented. The bivariate case, for example, generalizations of the scatter diagram, is considered in detail and the biomedical variable pair, bone age and chronological age, is used to demonstrate the application of this new graphical procedure.

Before proceeding to the sections of this paper that deal with the systematization and exemplification of graphical methods in biometry, it may be worthwhile to offer a brief explanation concerning what we consider to be the particular relevance of the *new* graphical procedures to biometry. By way of contrast, the following quotation ([1], p. 1), provides a clear exposition of the purpose underlying what might be called the *old* graphical procedures:

“Time after time it happens that some ignorant or presumptuous member of a committee or a board of directors will upset the carefully-thought-out plan of a man who knows the facts, simply because the man with the facts cannot present his facts readily enough to overcome the opposition. It is often with impotent exasperation that a person having the knowledge sees some fallacious

Research supported in part by small grant to faculty—Dr. M. Tarter General Research Support Grant 5 S01 RR5441-10.