

inaccurate. This will bring a prompt snort from many: "What use are statistics that are highly inaccurate?" The answer may be difficult for persons not deeply trained in social science statistics. Let us begin this way. The most accurate of all sciences is astronomy. Some astronomical data are carried out, in accuracy, to many digits, the length of the year to 10 digits. And yet those same astronomers sometimes offer us statistics whose Probable Error is 1,000%! Say on the distance of an undistinctive star, or on the number of habitable worlds. Why do astronomers, *virtuosi* of accuracy, sometimes offer us such vastly inaccurate statistics, whose very first digit is probably wrong? Why? *Because they understand that some faint idea of magnitude is better than none at all*—and an idea with a probable error of 1,000% is better than one probably 10,000% wrong. None of our statistical guesses will be so wild as some of those astronomers', and we shall endeavor to give some idea of the probable degrees of inaccuracy.

[10] As astronomy is the oldest, most accurate, and one of the most perfect sciences, so the social sciences are the youngest, least certain, and least accurate. One may say that no social statistics are ever true beyond an average 2 digits, i.e., 1 part in 50, or $\pm 1\%$; and usually we must be content if our first digit is probably right. Constantly, social scientists give an air of greater accuracy by copying governmental or commercial statistics half a dozen digits long, although the later digits are not true in any real sense. Perhaps we report "736 people, accurately counted". But our accuracy is illusive, based on false assumptions of identity or equality, even if the *count* was accurate. A baby, a moron, and a great leader add up to three *what*? You said you counted 736 people. Just *what* did you count? Nothing of accurate significance, in any case. In this book we may count patents, or infringement suits, or dollars reported spent on research. All is individual variability and hence totals of we can't well say what; so we can only hope that we have got the first one, or at best the first two digits right. But yet and always *some* idea of a magnitude is better than none, and an inaccurate guess is better than a *very* inaccurate guess, and constitutes an advance in the building of our science.

[11] How should our degree of accuracy-inaccuracy be expressed? There are various ways. The most elegant is a carefully calculated Probable Error, or else Standard Error, $\pm$ so much. A much easier and commoner way is by number of significant digits. Thus we should say that the amount spent on organized Research and Development (R&D) in 1961 was \$10.9 billion, not spelling out the sum to the last dollar or penny reported (certainly false). Usually we aim to set down two significant digits; any further ones are doubtless untrue or meaningless, even though they add very *slightly* to the chance of a bull's-eye.

[12] But now a difficulty arises. Say we have 2 of these rounded 2-digit numbers, 4200 and 3.6, that must be added, multiplied, or otherwise combined. Their sum, 4203.6, has 5 significant digits, yet the accuracy of only 2. Our statement's precision is 1,000 times greater than its accuracy. What to do? Round the sum to 4200 again? But that would obscure or deny the addition. Where the reader may wish to check or understand better our proceedings, we were best to leave it as 4203.6, begging him to remember these principles and not accuse us of faking 5 digits of accuracy. But where