Boltzmann equation without mentioning the divergence difficulties inherent in the multiple-collision contributions, except perhaps for a single cryptic statement on page 67.

The experienced toiler in the vineyard is likely to be more disturbed by frequent difficulty in dipping into a discussion in the middle of a chapter without having to look back through the book to determine the meaning of symbols. Someone familiar with a subject would like to be able to grasp the meaning from the context.

Notwithstanding these reservations, the book is a significant piece of work. One final remark: it is good to have a book in which some of Cercignani's own considerable contributions to the field are discussed at length.

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Scales and Weights: A Historical Outline

B. Kisch
297 pp. Yale U. P., New Haven, Conn., 1965 (3rd printing, 1975). $20.00

This book deals with scales and standard weights used for weighing from antiquity through the 19th century, in terms of the artifacts in museum collections around the world, with about 100 photographic illustrations. In these times when all the world is coming to the use of a single standard of units for all measurement—the SI units (*Système International d' Unités*)—it is interesting to read a good historical review of the tremendous variety of weights that have been used in the past.

Most of us know that the pound, the ounce and the dram are units that have different sizes depending on whether they are avoirdupois or troy (apothecary) units, but I had never realized that different standards of weight were formerly used for ordinary commodities in the marketplace. Bruno Kisch has made a special study of the history of weighing in the city of Cologne; he tells us that, in the 14th century, the weight of a centner (100-pound weight) was 100 pounds if silk was being weighed but 106 pounds for yarn and 120 pounds for iron. The author quotes Paetus (c. 1573) to the effect that "Whereas different people, particularly the Greeks, had different weights for different goods, the Romans had for all things only one weight unit: the libra . . ." and its subdivisions.

In different countries, and indeed in various cities and towns within European countries, up to the 19th century there were differing standards of weight. The author says, "The Magna Charta (1215) stressed the point that uniformity of weights and measures should exist in England. However, even in 1794 Martin was deploring the difficulties arising to men of trade and commerce from the variety of weights and measures used in different parts of England."

Although weighing dates back to around 3000 BC, as indicated by Egyptian, Assyrian and Hittite reliefs showing the use of balances, weight is still not used universally as a basis for commerce. Cortes reported back to Spain in 1521 that the Mexicans sold everything by number or volume but never by weight. The fishmongers of Cologne were ordered in 1482 to sell salted fish by weight, and Chambers is cited as saying that butchers were not required to sell meat by weight in some parts of England in the early 18th century. And we still buy eggs in the US by the dozen, with different prices for extra-large, large, medium and small eggs.

Kisch is curator of the Streeter Collection of Weights and Measures at Yale University; he mentions in this book a number of interesting weights in his own personal collection. He lists some 64 collections in Europe and Israel that he has visited personally, and there are twelve pages of bibliography from which he has culled material for this scholarly book.

His interest is in the artifacts rather than in metrology. In his very brief discussion of exactness of weighing, he tells us that three "exact" copies of the standard Cologne mark, made in Vienna in 1703, were found to differ by more than half a gram (ranging from 467.548 to 468.125 grams) when weighed more accurately in 1870. Kisch goes on to say that the sensitivity of balances was not to be blamed because the small scales used by money changers and pharmacists had a much higher sensitivity than half a gram. This statement is a slip on the author's part, for he probably knows that a sensitivity of 0.1% would correspond to 0.005 gram in 5 grams but to only 0.5 gram in 500 grams.

The scales presented include those with weights hung from opposite ends of a beam balanced on the finger; beams with equal arms and a fixed fulcrum; steelyards with fixed, unequal arms; steelyards with a single weight adjustable to various distances from the fulcrum; folding scales packed with their sets of weights in small wooden cases and used particularly for weighing money, ducat scales with equal arms but with one pan heavier than the other by just the weight of a coin and others. The weights presented are described in terms of actual weight in grams, material of construction (stone, brass, iron, glass and so on), shape (trussed duck, animals, busts of men, truncated cones and spheres, cylinders, rectangular shapes, nested weights or whatever) and maker.

Kisch pays a good deal of attention to the mastersigns of the makers, who were regulated by their medieval guilds. The names, metric equivalents and special symbols of the various weights of many countries and cities are given in detail. Much attention is given also to the role of governments in regulating the standards and providing official sealers to check weights and scales periodically and to mark them with special signs of approval. The author tells a good deal about the development of the platinum–iridium *"kilogramme des Archives,"* which is now the standard unit of weight, in terms of which even such non-SI units as the pound are defined.

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Computer Power and Human Reason: From Judgment to Calculation

Joseph Weizenbaum
300 pp. W. H. Freeman, San Francisco, 1976. $9.95

The idea of a stored-program computer leads immediately to studying mental processes as abstract computer programs. Artificial intelligence treats problem-solving mechanisms non-biologically, and modern cognitive psychology makes information-processing models of the human mind. Both studies have proved fruitful though difficult and have been pursued with ever increasing vigor.

Progress in either study, like Darwinism and like most progress in medicine and biology, moves the scientific picture of man's nature directly away from the subjectivity preferred in modern literary culture. Full success, like successful genetic engineering, will present individuals and society with a bewildering collection of options. Joseph Weizenbaum fears both the options he can imagine and the rationalist world-view that computer modeling reinforces.

The author criticizes all present work in artificial intelligence, information-processing-based psychology and computer linguistics as mere technique. In particular, he regards the computer linguists as "hackers" whose work there is no point in studying, but he explicitly puts no limit on the potential problem-solving capability of computers except when understanding humans is required. His point is moral, and his arguments use the 1960's technology of moralistic invective.

Weizenbaum finds it immoral for a scientist to adopt certain hypotheses even tentatively, to perform certain experiments or propose certain applications—not because they are dangerous or won't work, but because they are "obscene." He distinguishes between not closing