There is the distinct impression throughout the book that the present "muddling through" based on the completely internalized criteria of the decision-making few is to be preferred to any attempts to explicate, much less "rationalize," the process in which they are embedded. Rather than appreciate the fact that in systems analysis uncertainty must be *accounted for* and *incorporated*, Hoos treats this as grounds for accusing the analyst of trying to "manage and control" it.

The general misuse of technology (not necessarily associated with systems analysis) is also discussed, with emphasis on educational devices and on management information systems (MIS). These once fertile fields have been plowed so often by so many others that it is not surprising to find no new insights or syntheses here. (The MIS material appeared in abbreviated form in *Management Science*, June 1971, and was severely and appropriately criticized by E. C. Nelson in the February 1972 issue of that journal.)

Finally, one must make mention of the author's literary style. The volume reads as if it were put together out of a number of separate papers (my guess is five); that would explain the extensive repetition of ideas, arguments, and phraseology (I stopped counting *gemütlich* and *Weltanschauung* after five uses apiece). An example of the author's verbiage at its worst: "this concrescence of interests leads to an intense degree of commensality, where the condition of mutual sustenance thrives in the environment surrounding system analysis"; and at its best: "[a particular subjective bias] may be camouflaged by methodological purfling and technical footling." The characters of the book are as black-and-white as those in an Alan Drury novel. Systems analysts use "facile equations" and "arbitrary and unchallenged presumptions," they are from "ranks . . . swelled by university based or associated entrepreneurs, often in institutes" (the author, whose claim to expertise in analyzing systems analysts derives from her experience in retraining the work force, is associated with the "Institute" of Economic Affairs and is "based" at the University of California, Berkeley); they protect "vested business and professional interests" while weaving a "semantic web permeated with salesmanship" in order to "ply their trade wherever there is a willing customer"; the result, obtained by traveling "a pre-magnetized course," is eventually "thoughtfully placed" in one of "a plethora of little journals." On the other hand, the poor governmental clients, who are "otherwise well informed and sophisticated persons," should rather seek out, presumably, omniscient persons who would discover "solutions [which] face pragmatic tests" by means of "normative, value-laden compassionate judgment," "anchorage in appropriate discipline and theory," and "political and social rationality" (as contrasted to economic rationality), which "reasonably, logically and necessarily [why not rationally?] belong in government decisions. . . ."

There is a paragraph, which the author may accuse me of quoting out of context, that I cannot disagree with:

> Systems analysis has a great future as a means to justify or to shake up the bureaucratic status quo. The kind of case made for maintaining or abandoning the existing organizational structure depends on the way objectives and performance measures have been devised. Functional and jurisdictional re-alignments, supported by "rational" and "logical" arguments and crafted in the name of more efficient operation, can be proposed and defended. "Scientific" cooperation can be cited as reason for attacking a problem not only across traditional bureaus and divisions but also outside jurisdictional units and boundaries. In effect, here is a tool for *circumventing traditional checks and balances* and undermining, for better *or worse,* the bureaucratic structure. Moreover, the techniques of systems analysis can, if used astutely, remove highly charged political issues from the arena of public debate by *relegating* them to "scientific" appraisal. They can, by the same token, enable public officials to examine questions implicit in many problems but avoided because of their politically sensitive nature. [Italics added.]

The book under review concentrates on implications of the italicized words and the pejorative quotation marks in this paragraph; it neglects its nonfacetious interpretation.

Comparing the methodology of systems analysis to divination by "observation of the flight formations of birds or examination of the viscera of beasts," Hoos remarks that "for the uninitiated, understanding is less important than believing." One straightforward conclusion she neglects is that there should be fewer "uninitiated" in public policy-making positions. Her harangue will not greatly advance their sophistication.

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On Analytical Techniques

New Directions in Atomic Physics. EDWARD U. CONDON and OKTAY SINANOĞLU, Eds. Yale University Press, New Haven, Conn., 1972. In two volumes. Vol. 1, Theory. xiv, 250 pp., illus. $12.50. Vol. 2, Experiment. xvi, 164 pp., illus. $7.50. Yale Series in the Sciences.

These two volumes comprise 17 chapters by 13 lecturers at a NATO Advanced Study Institute in Izmir, Turkey, during the late summer of 1970. The informal atmosphere of the lecture room is captured best by the experimentalists, particularly Kastler. His contributions on optical pumping are marked by plenty of diagrams, a direct and uncomplicated style, and even occasional recapitulation. Marrus, too, gives an account of recent experiments with atomic beams in a sound, straightforward presentation.

The contributions of the theoreticians tend to be review articles of varying complexity and conciseness. Garstang's description of astrophysical applications is directly based on a wide variety of physical phenomena, but most of the other articles limit themselves to more sober aspects of the N-body problem. It is here that something of a difficulty becomes apparent. For the new directions that the reader can expect to learn about are recent developments in a subject that goes back almost half a century. The analytical and computing techniques have receded from their simple origins to a point where considerable expertise is required to follow them in any reasonable detail. Merzbacher describes the methods of second quantization with the clarity that has come to be expected of him, but other writers are more ambitious and consequently run greater risks in attempting comprehensive expositions. It would be difficult, for example, to appreciate Moshinsky's analysis of the $2s$-$2p$ shells without some prior knowledge of the theory of compact groups, though his lengthy introduction is excellent. As for Wybourne's chapter, the widespread use of the algebra of plethysm makes his description of group-theoretical methods rather more remote. But at least these articles yield their fruit when read in conjunction with readily available textbooks. The same cannot always be said of those contributions that depend critically on the use of computers. As soon as the writer calls for his first subroutine, the vital thread linking the initial hypotheses to the final numerical result is

weakened. Many a theoretician uses a computer as a kind of experimental adjunct to his work; but he himself must interpret the laborings of the machine if the analysis is to carry conviction. Scientists who use computers seldom realize how much the intrinsic interest of an article is threatened by representing the computer as a black box. The editors seem to have appreciated the key role that computers play, for two chapters (by Mayers and Froese-Fischer) deal explicitly with the mechanics of working with them. In spite of this sensitivity to the needs of the reader, the articles by Sinanoğlu himself are too concise to be immediately useful.

An added sense of dissatisfaction is felt when the elaborate computational techniques fail to give striking improvements over elementary methods. Sinanoğlu presents an analysis of the excited configurations of a number of light atoms; but it is something of an anticlimax to learn that his programs so far overshoot the experimental values for certain term-separation ratios that the error given by the most naive theory is reduced by a factor of only 2. One wonders how well other theoreticians, such as Kelly or Nesbet, would fare. However, Sinanoğlu and Nicolaides are more successful with their calculations of line intensities.

Aside from the problem of maintaining the reader's interest, there lies the risk that the accessibility of the computer may inhibit the desire to improve analytical techniques. This point is stressed allegorically by Wybourne. No doubt the ambiguous function of the computer will be under increased scrutiny in the years ahead.

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Solution Chemistry

The Chemical Statics and Kinetics of Solutions. E. A. MOELWYN HUGHES. Academic Press, New York, 1971. xiv, 530 pp., illus. $29.50. Physical Chemistry Series.

The title of this book should not be taken as an indication that the contents are devoted equally to equilibrium and kinetic properties of liquids and solutions. In fact, only 3 of the 16 chapters (plus a few isolated sections) deal with equilibria; even one of these chapters is concerned largely with statistical mechanics appropriate to an ideal gas. This section of the book, because of its brevity and an average age of about 30 years for the references cited, does not provide an adequate introduction to the present status of the very broad topic of molecular interactions in the liquid phase. However, it does serve the purpose of establishing a basis for topics treated later in the book.

What about the remaining chapters on chemical kinetics in solutions? Since Moelwyn Hughes and his students have been prolific workers in this field, one might expect the assistance of an experienced guide in traversing this area. It becomes apparent, however, that one is being led along a rather narrow path, with little opportunity to see far on either side of it. As he implies in his preface, Moelwyn Hughes is an advocate of the collision theory of reactions, and uses it to the almost complete exclusion of activated complex theory. This is a minority viewpoint, for there is general agreement that the assumptions behind activated complex theory should be most valid for reactions in solution, whereas the definition of a collision in a condensed phase becomes somewhat arbitrary.

Again, in the discussion of reactions involving substitution at the carbon atom, the viewpoint is that of classical electrostatics, with almost no attention given to a more detailed description in terms of wave mechanics or chemical bonding.

Several topics, such as the steady-state assumption, activated complex theory, quantum-mechanical tunneling, and isotope effects are treated awkwardly or incorrectly. There are some outright mistakes, as in the section on the base-catalyzed bromination of acetophenone. The author gives rate data for reactions of OH^-, OD^-, and OT^- with acetophenone-d_3, whereas reference to the original paper shows that the data are for reactions of OH^- with acetophenone, acetophenone-d_3, and acetophenone-t. One's confidence in the book is shaken by this sort of error and by the generally sloppy editorial work in both text and references. Among the more amusing examples are a measurement made "nanometrically" instead of "manometrically" and the variations on the name of Martin Karplus, who appears as K. Marplus in the author index and once in the text, but as Marples in three other places in the text.

It is particularly regrettable that Moelwyn Hughes has overlooked many recent references, the citation of which could have made this book a useful starting point for further reading. Perhaps one should not be concerned about a "generation gap" in literature citations, but an average age of 30 years is much too old in a field as active as chemical kinetics. This is revealed, for example, by the complete disregard of the definitive work of R. A. Marcus in the fields of electron-transfer reactions and unimolecular reactions.

This book does have some positive features. The inclusion of many primary kinetic data and the detailed treatment of the pertinent rate expressions will be useful to teachers of chemical kinetics. The chapter on fast reactions contains lucid, brief discussions of several experimental techniques, and then gives a very thorough treatment of ultrasound absorption as an example of relaxation methods. However, in view of the cost of this book and the availability elsewhere of more complete discussions of many of the topics, it seems to miss the mark both as a textbook and as a reference work.

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Manifesto

An Archeological Perspective. LEWIS R. BINFORD, with a contribution by George I. Quimby. Seminar Press, New York, 1972. xii, 464 pp., illus. $11.95. Studies in Archeology.

This book can be read as two books, "A" and "B," one inserted in the other.

Book B is a book on Lewis R. Binford: an autobiography which sometimes has the character of a very personal archeological novel on the birth and growth of a school in American archeology. To its author, it seems to be important that this should be seen as "New Archeology." With due respect, one could prefer to postpone this classification and use a more descriptive label—for instance "the Binfordian movement." The author says his presentation is "frank and open," and the discussion "sometimes overpersonalized." This is so. Sometimes he hurts. Nevertheless, these chapters will give a better understanding of the background and coherence of a remarkable contribution to archeology, and they enable the reader to see some of its strengths and weaknesses better. The reviewer—