jects) but rather are encouraged to engage their governors directly. Finally, in the contemporary city halls of the past three decades, much of the ceremonial aura that still survived in mid-century structures has been replaced with a simpler, but still often manipulative spatial design. One's standing in the system and where one stands in this cere-monial space tend to be less obviously related; boundaries between groups tend to be much softer. At the same time, new spatial "nodes" for the bureaucrats who are increasingly important for city government have been created. In some cases, tradition, less important in the mid-century buildings, has been given a new role. One admires, for instance, the use of the Indian kiva as a model in Scottsdale, Arizona, since here the communal circle is a fitting emblem of shared power. That Scottsdale is not readily organized tribally, however, suggests the role of subtle manipulation in these new buildings.

Goodsell's book is full of insights into how the structuring of architectural space mirrors and perpetuates models of social order. Richly illustrated with very effective photographs and many sche-matic drawings, it represents a truly new way of looking at, talking about, and understanding the roles of architecture in making room for (or denying a place for) certain kinds of public behavior.

Atanasoff: Forgotten Father of the Computer, by Clark R. Mollenhoff. Ames: Iowa State University Press, 1988. xv, 274 pp. Illustrations, appendixes, bibliography, index. $24.95 cloth.

The First Electronic Computer: The Atanasoff Story, by Alice R. Burks and Arthur W. Burks. Ann Arbor: University of Michigan Press, 1988. xii, 387 pp. Illustrations, notes, appendixes, bibliography, index. $30.00 cloth.

REVIEWED BY BERNARD O. WILLIAMS, UNIVERSITY OF KANSAS

These are perplexing books. Both deal with the controversy surround-ing the 1973 ruling by Federal Judge Earl Larson that John W. Mauchly derived the idea for an electronic digital computer from John V. Atanasoff during a visit to Ames in 1940. Any serious student of the history of computing will be interested in the arguments pre-sented in these books.

Clark Mollenhoff's book is a journalistic romance, presenting John Atanasoff as the brilliant pioneer of electronic computing, and depicting John Mauchly as a rogue and a thief. Alice and Arthur Burks offer detailed discussions of the design and operation of both Atanasoff's machine and the Electronic Numerical Integrator and

Computer (ENIAC). They conclude that Mauchly stole not just the central idea of digital electronic processing, but also actual switching design techniques and structural features from Atanasoff's machine. Both books are interesting, very well written, and persuasive, but both are also seriously flawed as historical studies. Each claims to have objectively settled the debate over who invented the electronic digital computer. Neither is finally convincing on this point, but each provides a wealth of information on this acrimonious dispute.

For decades the ENIAC, built at the University of Pennsylvania between 1943 and 1945 by a team that included Arthur Burks, was assumed to have been the first electronic digital computer. John Mauchly, the instigator of the ENIAC, and J. Presper Eckert, its main designer, applied for patents, formed a manufacturing company, and marketed the most famous of the first commercial computers, the UNIVAC. After years of patent interference proceedings, the ENIAC patents were finally granted during the 1960s. By that time the Mauchly and Eckert company had been absorbed by Sperry-Rand. Sperry, interpreting the patent as applying to any electronic digital computer, had previously established cross-licensing agreements with IBM and Bell Telephone. After the patent was issued, it demanded royalties from Honeywell.

In 1967 Honeywell sued Sperry, claiming that the ENIAC patents were invalid and that Sperry's agreements with IBM and Bell Telephone violated antitrust laws. The litigation in the U.S. district court in Minneapolis lasted more than five years. The original trial required more than a year and included more than 150 witnesses. The trial transcripts run to more than twenty thousand pages, supplemented by more than thirty thousand exhibits. Much of the trial focused on the economic conditions of the computer industry in order to determine whether Sperry had engaged in unfair trade practices. This issue is not examined in detail by either Mollenhoff or the Burks, however. Instead, both books focus on the argument over the validity of the ENIAC patents. Judge Larson ultimately ruled that the ENIAC patents were invalid on a number of procedural grounds. But he also ruled that Mauchly had derived the idea for an electronic digital computer from John Atanasoff.

Working at Iowa State College in Ames between 1937 and 1941, Atanasoff had designed and built a machine for solving sets of up to thirty simultaneous equations. Mauchly visited Atanasoff in June 1940 to learn about Atanasoff's machine. When the patent was filed for the ENIAC, however, no mention was made of Atanasoff's work as "prior art." (Applicants for patents are legally required to identify any earlier work that is a basis for the innovation being claimed in the application.)

Although Mauchly maintained that he had been working on both digital and analog methods prior to meeting Atanasoff, Judge Larson was convinced by the evidence and arguments presented that Mauchly had been interested only in analog computers before meeting Atanasoff, and that Mauchly therefore must have derived the essential idea of digital electronic computing from Atanasoff.

It is possible that Judge Larson's ruling was correct and that Mauchly had not thought of an electronic digital computer before meeting Atanasoff, but it is not likely. By 1940 a number of different projects were under way to prove the feasibility of electronic digital computing. These projects were being coordinated by the same people who were funding some of Atanasoff's research. Letters between Mauchly and Atanasoff introduced by Honeywell's lawyers to discredit Mauchly's recollection of the insignificance of the visit reveal that both Mauchly and Atanasoff already had some knowledge of these efforts. Some of the thousands of exhibits in the trial show evidence of this other work, but it was not emphasized by the Honeywell brief, and it is totally ignored by Mollenhoff's narrative.

It is plausible that Mauchly did not learn anything from Atanasoff that was later used in the ENIAC. Atanasoff's machine was an electronic computer in the sense that electronic circuits performed the control and arithmetic processes, but the machine worked at mechanical speeds and could only perform the single operation of adding or subtracting charges on banks of capacitors embedded in two rotating plastic drums that served as the working storage of the machine. By contrast, the ENIAC performed its calculations by moving only electrical charges, recorded in ring counters built on flip-flop circuits, and therefore could operate at very high speeds. The ENIAC could also be programmed to perform entirely different types of calculations by resetting banks of switches and rearranging the interconnection of its units through a system of hand-plugged cables. The scale of the ENIAC was also very different from Atanasoff's machine. The Atanasoff-Berry Computer (ABC), as it is now usually called, was about the size of a large desk. The ENIAC covered three walls of a room in an eighty-foot U-shape, and contained 18,000 vacuum tubes, 70,000 resistors, and 10,000 condensers. It included more than forty panels of electronic equipment, each one eight feet high, three feet deep, and two feet wide. With this sharp contrast between the two machines, one wonders if Sperry's lawyers took seriously the claim of Atanasoff's priority.

Just what John Mauchly learned from John Atanasoff continues to stir bitter controversy among the survivors of those events. The first chapter of Mollenhoff's book continues the bitterness with a charac-

ter assassination of Mauchly. Mollenhoff opens with a review of Mauchly's changing versions of his visit to Atanasoff in Ames. Mauchly eventually acknowledged that he had seen much more of the machine under construction than he had claimed in his first pretrial deposition, but he persisted in his claim that he learned nothing significant from Atanasoff. He maintained that he had a poor memory, although Mollenhoff reports that Mauchly told Atanasoff during the months of pretrial depositions that Sperry's lawyers thought it was best for him not to remember.

Mollenhoff says Judge Larson implied that Mauchly lied under oath, and that only judicial restraint kept Larson from calling Mauchly a liar. Larson's judgment, however, was more evenhanded than Mollenhoff's description. In a long and complex opinion Larson affirmed that "Mauchly may in good faith have believed that he did not derive the subject matter claimed in the ENIAC patent from Atanasoff." The judge also acknowledged that "Atanasoff saw the ENIAC machine as it existed on October 26, 1945, and in early 1946 extensive publicity was given to the ENIAC project, acknowledging Eckert and Mauchly as the inventors, but Atanasoff did not assert that the ENIAC machine included anything of his until two decades later" (John Larson, Decision October 19, 1973, District Court, D. Minnesota, Fourth Division, *Honeywell Inc. v. Sperry Rand,* in *The United States Patents Quarterly* 180 [1974], 716–17).

Mollenhoff claims to present the triumph of an objective judicial system establishing historical truth, but actually provides a partisan view of the strategy by which patent lawyers for Honeywell used John Atanasoff to attack the ENIAC patent in a legal battle over Sperry-Rand's claim to manufacturing royalties. Mollenhoff's detailed account of the discovery of Atanasoff's early work by the Honeywell lawyers and the means by which they arranged to use his machine as a legal weapon make especially fascinating reading. His few other chapters on the early life and work of Atanasoff and his student Clifford Berry are worthwhile, but are less than a biography of Atanasoff.

Mollenhoff tells a dramatic and interesting story, but he provides very little information about the way the disputed machines worked. Alice and Arthur Burks, on the other hand, present a very detailed description of both the ABC and the ENIAC. Their careful explanation of the machines is their most useful contribution. They want to construct a "causal chain of events" leading from John Atanasoff through the ENIAC to the machines of today. They acknowledge other work of the period, such as the gun computer projects at MIT and RCA, but place that work outside their "causal chain." They go

too far in reading later developments back into Atanasoff's designs. For example, they see Atanasoff's rotating banks of capacitors as influencing all later generations of regenerative memory devices. This connection would hold only if all later regenerative memory depended on Mauchly's transmission of Atanasoff's ideas. This claims too great a role for either Mauchly or Atanasoff. The history of computer design is a complex web of events, far too varied to represent as a linear causal chain or as a struggle between brilliant innovators and opportunistic rogues.

Labor in Illinois: The Affluent Years, 1945–1980, by Milton Derber et al. Urbana and Chicago: University of Illinois Press, 1989. vii, 455 pp. Appendix, index, bibliographical notes. $47.50 cloth.

REVIEWED BY PETER RACHLEFF, MACALESTER COLLEGE

As teachers, most of us like to tell our students that history is "everything right up to yesterday." As researchers, those of us who dare to venture onto the terrain of the recent past often find a minefield. Two years ago, when I was at work on a study of a just concluded strike— and struggling with it—a colleague commented, "Isn't it easier dealing with a topic when everyone concerned is dead?" Professor Milton Derber and his graduate student associates deserve considerable credit for the chance they have taken here.

In their effort to do justice to a diverse and complex topic, they have assembled a very interesting book that addresses experiences relevant well beyond the borders of Illinois. The authors point out that Illinois is a useful microcosm for the nation's workforce and labor movement, and its trends—while explained in places by largely local factors—followed national patterns quite closely.

The diversity of the authors' approaches provides multiple windows and enhances this book's value for readers with no particular interest in Illinois. The text is divided into five parts. Part one, "The Working People of Illinois," provides a demographic and economic picture of the lives of Illinois workers (nonunion as well as union) since World War II. Part two, "The Organizational Picture," includes case studies of seven very different unions. Part three, "Labor, Politics, and the Law," looks at electoral and lobbying activity, as well as the changing stance of the political and legal system towards labor. Part four, "Labor in the Community," includes case studies of six cities, as well as a consideration of community service and labor education. The final section, "Social Forces," examines themes that cut across particular unions and specific communities: "The Decline of Labor