ESSAY REVIEWS

The Art of Building in Its Many Forms

Karl-Eugen Kurrer, *The History of the Theory of Structures: From Arch Analysis to Computational Mechanics*

TOM F. PETERS

Five years ago, I reported in these pages on the first and very successful German edition of this book—a seminal work that explores new historiographical possibilities in the history of technology. Everything I wrote then holds true for this inspired, expanded edition, and then some. I would refer the reader to that review, especially for a description of the book's multileveled structure and contents (*Technology and Culture* 45 [July 2004]: 664–66). Now, five years later, the two wishes I expressed, that the study might someday be translated into English and expanded to include more of the Anglo-Saxon development of engineering science and of variant ways of thinking, have come to pass, and we have Karl-Eugen Kurrer's revised *The History of the Theory of Structures* (Berlin: Ernst & Sohn, 2008, pp. 848, €119).

The translation has been expertly rendered, the text completely reworked and expanded from 539 to 848 pages, and its complexity has been correspondingly augmented. As in the original German version, the book is multifaceted. It provides aperçus from areas that one would not normally associate with such a supposedly analytical topic, and it is copiously illustrated with diagrams, construction details, and structures, and photographs of working environments, publications, models, manuscripts, advertising ephemera, and portraits—667 illustrations in all. The scope of the visual material alone is evidence of the unusual, matrix-like nature of the study.

As I wrote in the previous review, a periodization permeates the book and serves to string the heterogeneous aspects into a network of order. At first blush this may appear arbitrary, but its logic serves to organize the wide-ranging material. Kurrer defines four periods: Preparation (1575–1825), Discipline Formation (1825–1900), Consolidation (1900–1950), and

Dr. Peters is professor emeritus of architecture at Lehigh University.

0040-165X/09/5003-0012/669–72

JULY
2009
VOL. 50

Integration (1950 to the present). He then subdivides these into phases, the first into Orientation (1575–1700), Application (1700–1775), and the Initial (1775–1825). The second period is divided into Constitution (1825–1850), Establishment (1850–1875), and the Classical (1875–1900). The third consists of Accumulation (1900–1925) and Invention (1925–1950), and finally, the period in which we find ourselves today is split into Innovation (1950–1975) and Diffusion (1975 to the present).

The first section on the tasks and aims of the historical study has been supplemented in this version with an invitation that sketches the novel breadth of the book: it invites the reader to join the author in one or more of seven ways to discover the history of structural theory that he explains through images drawn from Franz Kafka and Friedrich Hölderlin. Kurrer encourages readers to develop their own subjective approach to this work; those who prefer the mathematics of analysis will find it and trace the development that way. Those who prefer the personal or anecdotal, the structural or constructional, will understand the development too.

It is even more difficult to do justice to the complexity of this edition than it was to the first. Kurrer himself refers to it as a "historico-logical jigsaw" (p. 605), but it is decidedly a poly-dimensional jigsaw puzzle! There comes a time in the development of any field when a need arises for comprehensive overviews of topics that scholars had treated in detailed studies in the pioneering years. Some thirty years or so into the development, the history of construction is now at such a juncture, and this book is one such overview. But it is far more that that: it breaks new ground in dealing with a whole field of human knowledge, not only "internally" (as did many of the earlier books on the history of the analytical side of building like those by Henry Cowan, Stephen Timoshenko, István Szabó, T. M. Charlton, and Edoardo Benvenuto) by treating it from the perspective of the subject matter itself, but also from the perspectives of the persons involved in the development, and their characters, interactions, and quirks as viewed through the lens of the sociopolitical situations in which they labored.

Examples among many are the implicit cultural aspect that Kurrer invokes in his discussion of the line of thrust in arch theory in Austria, France, Great Britain, and Germany (pp. 216–19), or the political aspect in his explanation of the early development of the ultimate load theory in the German and Anglo-Saxon world (pp. 127–33)—of which the professional and then personal aspect in the animosity between Fritz Stüssi and Bruno Thürlimann at the ETH in Zurich forms part (pp. 134–35).

Kurrer makes it clear that a whole *Weltanschauung* is called for if one wishes to discuss creative thinking comprehensively. Thus he incorporates philosophical issues, theories of perception, and aesthetics, he relates the problems with which they deal to his focus on theory, and he examines the split between the "art" of building as exemplified in architectural theory

and the engineering "science" of building in a novel way. Moreover, wide-ranging though his points of attack are, he invariably relates everything to the basic topic of his study: the theory of structures, and through that ultimately to the goal of all this thinking, as Ekkehard Ramm states in his introduction (p. 5), not only to analysis but also to synthesis, to the art of building.

The art of building takes many forms—procedural, aesthetic, structural, and material, to name a few—and Kurrer concentrates chiefly on the structural ones. The aesthetic issues he treats will interest historians of architecture, who may find his ideas unusual and thought-provoking. Although it does not belong within the purview of the main thesis of this book, one might have wished for more depth in the discussion of the relationship between new structural types, their comprehension (or development) through theory, and the formal interpretation they engendered in built form in both engineering and architecture. Bertolt Brecht's revisionist reaction to what Kurrer terms the "adoration" of the novel concrete structures by Neue Sachlichkeit architects (p. 544) reveals a negative aspect of the relationship, but this is by no means the whole story. To name just one example, the pioneering concrete engineer Robert Maillart's formal interpretations and sense of elegance in his many concrete structures as discussed by David Billington in his writings on that engineer might provide an interesting point of comparison with the Italian architect Giacomo Mattè-Trucco's celebrated 1923 Fiat factory building in Lingotto, Turin. Browsing the text is invariably rewarding. It inspires the reader's thoughts to wander in many directions.

Some of Kurrer's ideas may at first appear unconnected to his thesis, but they soon prove otherwise: for instance, the relationship between image, symbol, and text, and his observations on the gradual integration of these forms of communication. This question preoccupies Kurrer at the juncture between the classical and modern period in the development of theory. Surprisingly, he observes a lack of visualization in the early period, although the anecdotal nature of early imagery would have led one to expect the opposite. He explains this very personal understanding convincingly and the reader is encouraged thereby to explore further. It illuminates our current period in which symbols and visual literacy have become ubiquitous, and one can read this passage in conjunction with his study of the influence of computers on our thinking and finite element analysis toward the end of the book. This is only one of the many instances of unexpected and yet very logical conclusions we find hidden in the pages of the study that prove relevant to other fields in the development of technological thought.

A new section of this edition collects a series of controversies that explains in more detail the subjective side of theoretical thinking as Kurrer

JULY
2009
VOL. 50

states it (p. 675). This makes it clear that neither theory nor the development of scientifically based theory is independent of opinion or personality. Kurrer also subliminally calls into question the doctrine of science as "truth" when he looks at John Argyris's essay "The Computer Shapes the Theory" (pp. 619–20), and he goes on to explore the influence of finite element analysis on our current understanding of structures. He also treats his topic subjectively in the best sense, as a personally evaluated, albeit factually founded, view of the history of theory. In this book he does not continue this vein of thought to explore more radically nonscientific approaches to understanding structural behavior or criticize the positivist approach to the history of the field. That may be reserved for a further study. However, and this is most important, Kurrer does introduce the personality of the thinker as a constituent factor in the formulation of new knowledge. That in itself is a valuable expansion of thinking in this domain and a contribution to the sublimation of the futile dispute between invention and evolution.

One can read this book from cover to cover, but it is dizzyingly encyclopedic in scope and therefore perhaps better enjoyed by browsing randomly and picking out structures or topics with which the reader is familiar and then branching out to the new. One is rewarded by unexpected relationships that inspire reflection. Like all books of this breadth and complexity, it can also serve as a quarry for research. The extensive biographical appendix, expanded from the first edition by half, is useful because it goes beyond the biographical facts to build connections among people, their education, structures, and theoretical developments, and a succinct history of structural types incorporated in the text helps orient the reader in the daunting ocean of material.

As you can tell from my enthusiasm, I recommend this highly original study, first as a pleasure to read and a thoughtful examination of new avenues to explain the development of human understanding, and also as an aid and inspiration for further research.