

Wolfgang Lefèvre

Picturing Machines 1400–1700

Book Review

—Reviewed by

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P*icturing Machines 1400-1700* places the discussion of engineering drawing development in the context of the development of engineering activity in the Renaissance period, including the various communities who had interest in technical projects, the needs of the participants, and the link between the engineering work embodied in the drawings and the life setting of the intended product. The book is a set of chapters by different authors arranged into five parts that present a logical progression. Part 1 explores the purposes of drawings of machines. Part 2 discusses pictorial languages and the social position of the drawing community. Part 3 explores the issues of seeing representation in the drawing and knowing what it represents. Part 4 discusses the development of several relationships between the two-dimensional drawing and the three-dimensional shapes represented. Part 5 explores the linkage between drawings and the theory of mechanics and physics.

Drawing is a part of engineering communication which is necessary to clearly communicate intention concerning a product. As a means of engineering communication, the technical drawing has developed a set of representational conventions which today are taught and usually regarded as axiomatic. However, as technology develops, evolution in the drawing representation forms is required, and the need to clearly communicate particular information about the engineering product has resulted in the development of the current range of conventions. In this context, early drawings of mechanical devices appear strange because they predate current conventions and practices in engineering. In particular, as noted by

several authors in this book, engineering drawing from the Renaissance period appears to the modern eye, at first glance, to be naïve and possibly muddled. However, the naïvety of the drawing can be discounted because the style resulted from a conscious rejection of an earlier style of drawing. The authors grapple with aspects of how such drawings were effective in the development of engineering thought and practice, and led to the effective construction of many projects, while lacking much information that a modern engineer expects to find in an engineering drawing.

In the introduction, Lefèvre writes that the origin of technical drawing in the West at the end of the Middle Ages was associated with the development of new fields of technology for which existing communication methods were not adequate, and that there was rapid development of drawing style and technique. Another important feature of early technical drawing was that it served as an “orientation for manufacture” rather than as a blueprint for manufacture, making the purpose of early drawings quite different than that of current engineering drawings.

Poplow discusses the purpose of early modern machine drawing in Chapter 1, “Why Draw Pictures of Machines? The Social Contexts of Early Modern Machine Drawings.” During the late Middle Ages, there emerged a separation of engineers (people who conceived of machines) from artisans (those who made the machines). Both groups were distinct from the acquirers who funded engineering projects. This distinction of people and roles, which continues to the present, provided the impetus for some aspects of the form of technical drawings, because each actor has different needs to support their contribution to the engineering project. The role of the acquirers resulted in a significant emphasis on the interests and needs of the acquirers and, therefore, on the emphasis of the drawing in trying to communicate the function and usefulness of the proposed product, often to the extent of omitting machine elements that were

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essential to the structure but that would obscure the communication of its function and usefulness.

McGee builds on this theme in Chapter 2, "The Origins of Early Modern Machine Design," noting that many drawings which appear to be poor perspective drawings actually contain aspects of multiple contradictory views, such as elevation and plan views in a single image. These views were useful for communicating function and were intended for presentation to acquirers and as guides for expert builders for construction. The drawings were expected to perform this dual role, rather than to have multiple drawings, each intended to perform one of the roles.

Chapter 3 is a contribution by Leng on "Social Character, Pictorial Style, and the Grammar of Technical Illustration in Craftsmen's Manuscripts in the Late Middle Ages." Leng extends the discussion of the link between social status of the new design-related occupations and the development of traditions of drawing with a discussion of the new profession of gun-makers and the distinctive drawing tradition that they developed as a communication medium among themselves, seeking to maintain their distinctive knowledge only within their community and not letting it become broadly known. As a result, the gun-makers' drawings were different in style and technique from those of other engineers.

Long compares and contrasts the work of di Giorgio and da Vinci in Chapter 4, "Picturing the Machine: Francesco di Giorgio and Leonardo da Vinci in the 1400s," showing the place which technical drawing had for each of them. For da Vinci, drawing was a means of working out technical ideas and research, as well as of communicating ideas ready for presentation for implementation. Di Giorgio used drawing as a means to communicate an understanding of what happens in particular situations, with a view to demonstrate the expert's skill in dealing with situations rather than to impress with exciting but impractical ideas.

Chapter 7, by Henninger-Voss, is titled "Measures of Success: Military Engineering and the Architectonic Understanding of Design." Henninger-Voss discusses the drawing of fortifications that showed only the defensive structure, the intended structure, but never directly showed the nature of the attack anticipated, which was only in the mind. Geometry was used to provide clarity of design, but soundness of design was explored with models used in war gaming in which the

vulnerability of the design to certain attacks was explored. Henninger-Voss says that this focus of 16th- and 17th-century engineers on fortresses as static entities has resulted in engineering's current fixation on input and output relationships. This remark contrasts in a quite interesting manner with discussions of the drawings that predated these fortification drawings; the drawing style and technique resulted from trying to convey the function of the intended product, thus emphasizing its contribution to people's lives.

Camerota, in "Renaissance Descriptive Geometry: The Codification of Drawing Methods," proposes that the use of drawing as a means for expressing ideas about design started at the beginning of the Renaissance. Although it took much effort to learn how to draw, learning how to read drawing was more difficult because there was no established convention for drawing. The development of printing led to efforts to codify drawing practice, with particular attention to perspective drawing, which was developed to provide an understanding of the three-dimensional nature of objects, such as single projections, the development of methods to measure objects of a similar form and to photogrammetry. Lefèvre and Peiffer extend the discussion of the development of drawing methods and conventions in Chapters 7 ("The Emergence of Combined Orthographic Projections") and 8 ("Projections Embodied in Technical Drawings: Dürer and His Followers"), respectively. Their discussions concern the development of orthographic projections, with the common 16th-century practice of combining a ground plan and an orthogonal view to describe proposed buildings, and the development of concepts of projections developed by Dürer and his followers.

In the final chapter, "Drawing Mechanics," Mahoney discusses the relationship of technical drawing and the development of engineering reasoning. The desire to draw or write about machines was new. In the medieval period, thinkers were not impressed enough by machines to write about them, even though there were many machines in society, but in the Renaissance period, the process of drawing machines was developed as a means for thinkers to reason about machines and develop ideas for design. An example of the use of drawing to develop concepts of design was Huygens' and Thuret's development of a watch-governing mechanism.

Picturing Machines is well-written as history, with many original drawings and documents used as primary sources, as well as considerable use of the

secondary literature. Viewed purely as a history of a formative stage of engineering drawing, this book is a valuable contribution to the literature. However, the book is more than just this. In their historical and critical analysis of the drawing forms, styles, and techniques, the authors have discussed the reasons why technical drawings of this period are so different from modern technical drawing, showing that the early drawings are not poor attempts at modern drawing conventions, but rather are a distinctive form of technical drawing. The presentation of engineers, the people who did the drawing, while working between acquirers of engineering products and artisans who would make the products (but using a single drawing to communicate to both), points to a particularly interesting feature of Renaissance technical drawings in a theme that is moderately developed through the book. This theme is the

manner in which Renaissance drawing sought to capture the life setting of the intended product, communicating its functionality and purpose rather than just its form as material fashioned to a certain configuration. The common present engineering emphasis on the material and on formal input and output relationships of the product is mentioned, showing a distinct contrast to this understanding of products. It is only quite recently, with the development of systems engineering, that modern engineering has attempted to address this particular issue and to recapture the life setting concern expressed in the Renaissance drawings, but even in systems engineering there is a need to learn from what was valuable in the Renaissance drawing tradition. In addition to standing as a history of an important aspect of engineering, this book provides seeds to challenge and stimulate development in modern engineering practice.