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BOOK REVIEW

Walter Roy Laird, *The Renaissance of Mechanics: Ancient Science in the Age of Humanism*

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The Renaissance of Mechanics offers a thorough introduction and explanation of mainstream Renaissance theories and traces their roots to antiquity and the Middle Ages. Laird reviews the history of mechanics by scrutinizing a significant number of primary sources, including those that were only passed down in the Islamic world. The arrangement of the book follows the classic division, starting in ancient Greece, then moving to the science of weights in the Middle Ages, and their revival and integration in the Renaissance. The book not only covers better-known figures like Hero of Alexandria and Guidobaldo dal Monte, but also lesser-known authors like Blasius of Parma and Francesco Maurolico. When explaining historical theories, Laird employs redrawn diagrams to demonstrate core concepts of the theories with clear and non-anachronistic language, which is convenient for readers.

The first and second parts cover materials from pre-Aristotelean understandings of machines and arts in general to the end of the Middle Ages. The main figures largely follow the classic view of the sources of Renaissance authors: pseudo-Aristotle's *Mechanical Problems* came up with the principle of circular motion; Archimedes brought in the geometrical analysis of equilibrium and the notion of the center of gravity; Hero of Alexandria studied different mechanical devices, and the science of weights in the Middle Ages. Apart from a more complete understanding of this period from the rich knowledge of primary sources, Laird emphasizes Hero's *Mechanica*. Hero's work contains both the geometrical principles from Archimedes and his perspective on diverse mechanical devices. Hero divided all mechanical structures into five types and tried to reduce them all back to the balance, which later served as the source of inspiration for Guidobaldo and Galileo. However, another part of Hero's most important contribution was omitted in Pappus's *Collection*, and was thus lost until the nineteenth century. The lost work of Hero contains his alternative explanations of mechanical principles, which are dividing and sharing the load and the principle of compensation. The former is the idea of dividing an unmovable load into many parts that are less than the moving power, so the power would be able to move the divided loads separately. This is best seen in Hero's analysis of the pulley and the wedge. The latter is Hero's notice of distance, time and speed, since with the greater power gained through a machine, the device always requires a longer distance and time. Unfortunately, both these principles, which closely approximate Galileo's early mechanics, were hardly mentioned in Pappus's *Collection*, and thus remained unknown to later scholars.

In Part Three, Laird first gives a summary of the restoration and circulation of the ancient and medieval works, then introduces four main figures: Niccolò Tartaglia, Francesco Maurolico, Guidobaldo dal Monte and Galileo Galilei. Tartaglia is presented as the successor of the science of weight in the Renaissance, with an unsuccessful attempt to expand this science to a broader scope. Maurolico is treated as an important node of the emergence of 'moment'/*momentum* in mechanics, which is from ῥοπή. He took moment to be a combined power of weight and distance and used it in his explanation of equilibrium condition and centre of gravity. Guidobaldo dal Monte was the restorer of Pappus. His main work on mechanics, *Mechanicorum Liber*, first rebutted the science of weights with mathematical analysis on the approximation problems in their physical assumptions. The main body of his book centered on the Archimedean centre of gravity, Hero's five divisions and his attempt to reduce everything to the balance, with just a few innovations. His later unpublished works were more innovative and showed his interest in expanding the mechanical theories of equilibrium to motion, which possibly came from his collaboration with the young Galileo. Galileo's research on classical mechanics is mainly found in his early works. From his approach to mechanics, we can identify his intellectual origins from Guidobaldo, Archimedes, Hero (from Pappus) and his possible use of moment from Maurolico. Apart from that, Galileo developed the principles of compensation and dividing and sharing on his own, which are best shown in his general principle of mechanics and the explanation of the inclined plane and the force of percussion. His principles are fundamentally the same as Hero's, which is impressive considering that the original was not accessible to him. Building on this part, he also included speed in the concept of moment, trying to add motion to the play. These achievements not only show their link to ancient sources but also explain Galileo's two new sciences, which are not traditional mechanics but have clear connections to it.

The Renaissance of Mechanics exhibits considerable depth and a unique perspective on the history of mechanics. It covers the classic tradition and includes a complete integration of historical materials. The book itself is more than enough to serve as a textbook for the history of mechanics, considering its clear structure, stress on connections between authors and beautifully drawn illustrations. For those who do not read ancient languages or cannot access translations in French and German, Laird's book is the best choice for gaining a complete understanding of the material. For professionals in the history of mechanics, this book will inspire new understandings through the connections it builds. It replies to traditional views from authors like Pierre Duhem and Sillman Drake and gives new readings through the detailed analysis of the primary sources. It will lay the new groundwork for all future studies of Renaissance mechanics.

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