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Review: Ken Alder, The Measure of All Things: The Seven Year Odyssey and Hidden Error that Transformed the World (New York, 2002)

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The role of education as a formative and political tool of scientific and technological culture is an important theme that reflects the work of others, such as Bruno Belhoste, Janis Langins, and Antoine Picon.

Part three of the book focuses on programs for developing new forms of firepower and methods of testing devices such as incendiary and explosive projectiles. The central feature here is the renewal of French artillery rocket research in 1810, triggered by William Congreve's work in England, which Bret interprets as part of an international arms race underway from the Old Regime to the Restoration. This complex story of English, French, and Danish rocket designs and testing systems, shifting goals, and conflicting reports of success and failure illustrates Bret's original intent to "stay away from all anachronism and teleological vision" (p. 13). Bret also contrasts the characteristics of French applied research with its counterparts in England and Austria, and notes how the French model later influenced the United States, Russia, and Sweden. He concludes that the military research programs of the French Revolution indeed marked a major rupture in terms of scientific, technical, political, and administrative practice.

This book will be of considerable value to scholars, both as a research tool and as a sobering account of how the politics of science and technology in the West accelerated an embryonic international arms race. It contains a thorough index of names and lists French and international archives and secondary sources, but unfortunately lacks a subject index. The eight pages of plates are intriguing but not well integrated with the text, nor are there any illustrations interspersed in the text to clarify technical explanations. On the other hand, Bret's excellent tables both clarify his analyses and represent a technocratic image of a state that combined politics with the personal and professional networks of scientists to design and perpetuate military research programs for the development of terrifying weaponry.

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Dr. Pannabecker is a translator and instructor in electronic publishing and French at Hutchinson Community College in Kansas. His article "School for Industry: L'Ecole d'Arts et Métiers of Châlons-sur-Marne under Napoléon and the Restoration" appeared in the April 2002 issue of *Technology and Culture*.

The Measure of All Things: The Seven-Year Odyssey and Hidden Error that Transformed the World.

By Ken Alder. New York: The Free Press, 2002. Pp. x+422. $27.

The Measure of All Things is just what it claims to be: a page-turner about the definition of the meter. What's next, steamy romances about the development of the Erlenmeyer flask? If as entertaining and well written as Ken Alder's latest book, I hope so. Apparently, a discovery in the archives put him on the trail of a remarkable story. Browsing through thousands of

pages of records from the 1792 meridian expedition—formulas, logbooks, diagrams, calculations, maps—Alder happened upon a note by the astronomer Jean-Baptiste-Joseph Delambre in which he admitted to suppressing details and deceiving the public about the expedition. "I can still remember the shock I felt on reading these words," Alder writes (p. 6). From there, some fine sleuthing uncovered important materials in Santa Barbara, California, and Provo, Utah. Together, these documents revealed a fascinating story of scientific error and cover-up, of deception and self-doubt, that lies just beneath the surface of Delambre's imposing two-volume tome, *Base du système métrique décimal*.

Alder structures his narrative around the ventures and misadventures of Delambre and Pierre-François André Méchain, the two astronomers charged with measuring the meridian arc from Dunkirk to Barcelona. Armed with the latest in precision equipment, Méchain and Delambre set out from Paris in the summer of 1792. They traveled in opposite directions: Méchain went south and Delambre went north. Of course, these were not quiet times, and what was initially supposed to be a journey of about seven months turned into a seven-year pilgrimage. The two savants encountered foul weather, shabby bell towers, hostile villagers, and a host of other difficulties as they triangulated their way through the French and Spanish outback. According to Alder, though, the expedition was delayed by more than merely external obstacles; it was hampered by the deception, doubt, and self-loathing occasioned by a crucial error in Méchain's measurements.

The error that "transformed the world" cannot be understood apart from the Borda repeating circle, a cumbersome piece of equipment that Méchain lugged with him over the Pyrenees, across the Belearic Islands, and pretty much everywhere else he went. The principle behind the Borda repeating circle, as one might guess from its name, was repetition. Its design, described wonderfully by Alder, allowed geodesists to improve precision by multiplying the number of readings that could be made on a given angle. The Borda circles, intended to "eliminate virtually all error," produced measurements of unprecedented precision (p. 56). But the repeating circle may also have been responsible for the crucial error that tortured Méchain and nearly destroyed the meridian expedition. Arrested by the Spanish and confined to quarters in Barcelona during 1793, Méchain made some ten thousand observations to determine the precise latitude of his hotel there. He had wanted to account for a small anomaly in some earlier results, but the new latitude measurement now revealed "a stunning discrepancy" (p. 121). Méchain's error, and the actions it inspired—delay, deceit, and some serious tinkering with the data—drive the narrative the rest of the way.

Though written for a popular audience, *The Measure of All Things* skillfully incorporates many insights and arguments from recent historiography of science. Familiar themes from the work of Theodore Porter, Lor-

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raine Daston, and M. Norton Wise percolate through the well-crafted layers of Alder's narrative. He frequently combines these themes with a bit of psychological speculation to explain why the characters behaved as they did. "Precision is an obsession, and the sharp edge of Méchain's exactitude was cutting him up inside" (p. 213). This is generally persuasive stuff, but it sometimes runs the risk of becoming history of science lite.

Quibbling over methodology is really beside the point here, however. The important thing is that a professional historian has written a solid, entertaining, and informative book about the history of the metric system. That is no mean feat. In my experience, historians of science and technology spend a lot of time bellyaching about the lack of a popular audience for our work but do very little about it. The ugly truth is that very few of us are equipped to pull it off—it takes a certain flair and considerable talent. Judging by some of the early reviews in the popular press, Alder has succeeded in cultivating a larger audience for the kinds of issues that we routinely debate at professional meetings and in specialized journals like this one. We can all be grateful for that.

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La modernité au village: Tignes, Savines, Ubaye . . . La submersion de communes rurales au nom de l'intérêt général, 1920–1970.

By Virginie Bodon. Grenoble: Presses Universitaires de Grenoble, 2002. Pp. 359. €30.

The cover of Virginie Bodon's work—a woman turning from the destructive rush of water at her back—is eventually revealed (p. 301) as the playbill for Jean Giono's 1956 film, *L'Eau Vive* (Whitewater). Behind the cover is Bodon's study of the intersection of technology and community, in which two major dams are relegated to the role of prime mover. Serre-Ponçon, an embankment dam on the Durance that submerged Savines and Ubaye when it was completed in 1960, is at least identified by type. For its other characteristics, as well as those of Tignes, which blocked the Isère and was the highest arch dam in Europe when completed in 1952, see http://www.structurae. Bodon does note (without explaining) that Serre-Ponçon utilized a "technique imported from the United States" (p. 122), and it is nice to know that the United States was ultimately useful: in 1952, proponents of hydroelectricity had laid misgivings expressed by Savines and Ubaye at the door of "American imperialism" (p. 94).

Serre-Ponçon was originally contemplated in 1856, as an irrigation and flood-control measure that would also power regional industries and bring fresh drinking water to Marseilles. Tignes was conceived in 1919. The inter-