

IN WHICH EUROPE QUANTIFIES

[by John H. Lienhard](#)

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Today, why did Europe emerge like an express train from the medieval age? The University of Houston's College of Engineering presents this series about the machines that make our civilization run, and the people whose ingenuity created them.

Alfred Crosby looks at medieval Europe -- a cultural backwater by comparison with Islam and China. Then, by the 17th century, Europe had become the most technically advanced civilization in the world. So how did she change so abruptly between 1250 and 1600?

Others've asked the same question. If you'd asked me, I'd have said the change was driven by a set of new visual arts. Crosby includes those arts, but he sees something else that hasn't been given its due. He looks at quantification -- reducing nature and human activity to number. He titles his book, *The Measure of Reality*.

Take numbers: medieval scholars used only Roman numerals. The algorithms of arithmetic, multiplication and division, are hopelessly cumbersome without the concept of zero, and the Romans had no zero. The Mayans did, by the way, but Europe didn't know about that. Our zero came out of India, and was picked up by the Arabs.

The Arabs invented most of our arithmetic methods and they gave us the numerals that went with them. Their system, so obviously superior, entered the Renaissance on little cat feet, making small inroads here and there. It wasn't fully in place until 1600.

But other forms of exact measure were also evolving. Visualization was a matter of measure. Medieval artists hadn't sought to represent, but to evoke. A medieval artist might make the relative sizes of figures according to their importance instead of their positioning in the foreground or background. Then, 15th-century Italian artists perfected perspective drawing and gave us a way to measure reality by showing how things really look.

Finally, in 1525, Albrecht Dürer turned Italian perspective into our modern science of descriptive geometry, and art literally became a new form of mathematics.

Early medieval music was oddly without measure. The duplet and triplet patterns of Gregorian Chant go on, without drama, drawing us into contemplation. It's not about progress, it's about a timeless God. Modern musical notation evolved between 1250 and 1600 and its main feature is measure. Our notes measure time. In fact, music historians call it mensural notation. After 1600, music seemed to be going somewhere -- to the beat of musical measures.

And so we progressed to a new drum. We invented the mechanical clock and we invented [bookkeeping](#). Today, we look at all our so-called progress with justifiable suspicion. Are we really better developed as human beings than our medieval forbears were?

At the same time, our young are losing the focused quantitative sense that got us here, and that's frightening. No one would argue that quantification makes us more humane. But we might well fear for what we'll become if we try to leave measure behind -- now that we've reached this stage of our being.

I'm John Lienhard, at the University of Houston, where we're interested in the way inventive minds work.

(Theme music)

Crosby, A. W., *The Measure of Reality: Quantification and Western Society*. New York: Cambridge University Press, 1997.

I am grateful to Jim Bell, KUHF Radio, for suggesting the topic and lending me his copy of the Crosby book, and to Sohel Mahmud Reza for his paper in UH course MECE 3301, "Numerical Systems and the Introduction of Zero."

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