

Digital history

Some historians of science are moving away from the traditional image of lone scholars poring over ancient manuscripts. Alison Abbott talks to one of history's digital pioneers.

The informatics revolution, already in the process of reshaping biology, is now homing in on the history of science. An ambitious new initiative launched by the Max Planck Institute for the History of Science in Berlin aims to use the cutting edge of information technology to understand how scientific knowledge developed.

The initiative is the brainchild of Jürgen Renn, a physicist-turned-historian and one of the Berlin institute's directors. His idea is that all possible sources of information that have come down over the millennia should be digitized and made available in a form that allows the data to be mined beyond traditional barriers of language and academic discipline.

The basic idea of digitizing historical documents so that they can be accessed by scholars from all over the world on the Internet is not new. Renn, for instance, collaborates in the Cuneiform Digital Library Initiative, which provides virtual access to texts and translations from ancient Mesopotamia, dispersed in museums and private collections. But Renn is one of a new breed of historians who want to extend the approach. They intend to add multiple levels of annotation and to structure their databases so that they become fully searchable, regardless of the

language of origin — not just through key words, but also through the comparison of underlying concepts.

The effort required is vast because — as with genome databases — adding annotation to help interpret data entries cannot be fully automated; it is labour intensive and requires specialist knowledge. Realizing Renn's goals will also require the development of advanced search and matching tools that can analyse texts for contextual relationships between the terms they contain (see *Nature* 405, 112–115; 2000). More challenging, it will also require the development of translation programs vastly superior to those available today. But the approach should offer historians fresh opportunities to make connections that would otherwise remain obscure.

Privileged access

Ultimately, says Renn, the digital approach should strip history of its esotericism, opening up avenues of study that currently are closed to all but a few individuals with the necessary linguistic skills, expert knowledge or privileged access to documents and artefacts. Once the infrastructure he aims to build is in place, for instance, a historian should no longer need to employ a philolo-

gist to help interpret a manuscript written in an ancient Greek dialect, or in old Italian.

As a proof of principle, with colleagues from Tufts University in Massachusetts, Harvard University and the University of Missouri at Kansas City, Renn is embarking on a project on the history of mechanics, called Archimedes. Shortly before Christmas, it won an initial three-year, US\$1 million grant, funded jointly by the US National Science Foundation (NSF) and the DFG, Germany's main research grant-giving body, as part of the International Digital Libraries Initiative, a project set up and funded by the NSF and Britain's Joint Information Systems Committee.

The project is “both modest and ambitious”, says Renn. “Mechanics is a small part of science as a whole, yet the material that could be made available is almost inconceivably vast.” He estimates that the project could encompass millions of pages covering almost two millennia and several cultures and languages. Language analysis and translation programs developed for Tufts University's Perseus Project, which provides a digital library of ancient texts with modern translations, will be exploited and extended.

As its starting point, the Archimedes project will digitize and annotate the earliest text



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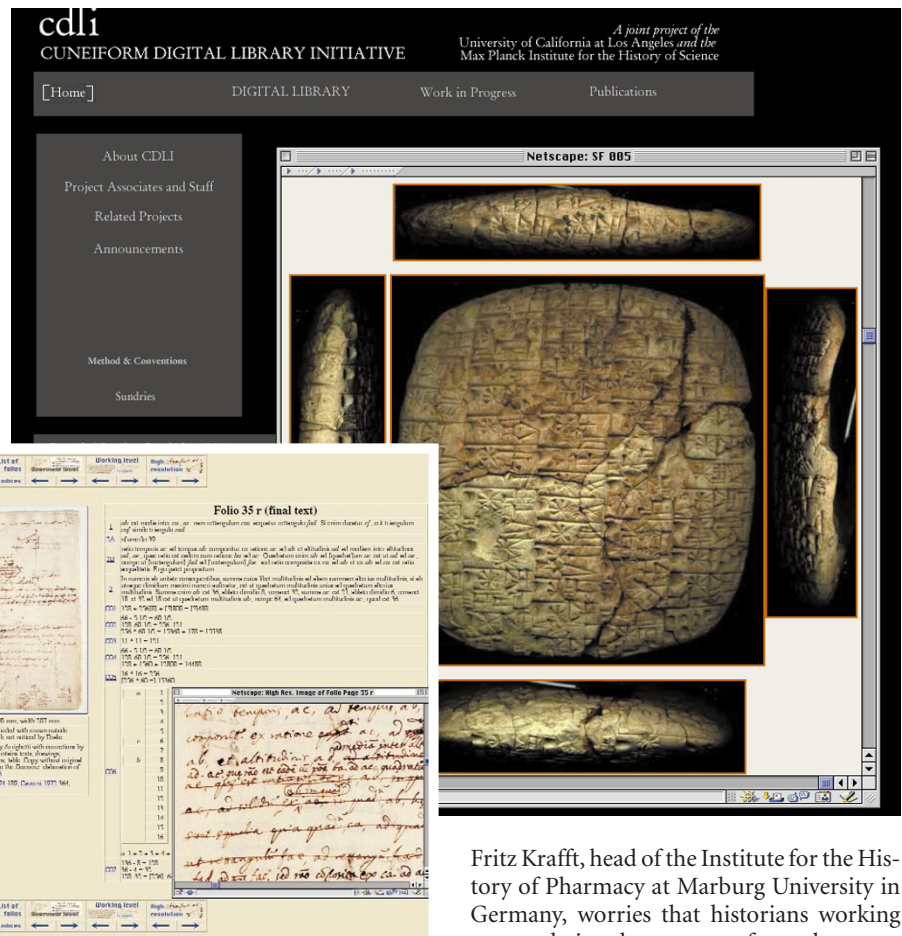
Building to last: Galileo's lab notes, Mesopotamian texts and Florence cathedral's (left) construction archives are among the treasures being put online by Jürgen Renn (above) and his colleagues.

on mechanics, a tract by Aristotle. Other documents and sources of information will be selected by half a dozen core historians, along with 20 or so experts from different disciplines. Some have already been digitized and annotated. For example, Renn and colleagues in Florence have put on the Internet Galileo Galilei's *Notes on Motion* — four decades' worth of the Renaissance scholar's laboratory notes of studies into mechanical problems.

In cooperation with another team in Florence, working on a project called the Years of the Cupola, Renn is now building an electronic archive of over 14,000 administrative entries relating to the construction of the city's cathedral. One of the wonders of the Renaissance, this building features an enormous self-supporting cupola, or dome, 46 metres across at its base, that was completed in 1434.

The Archimedes project will examine how knowledge about mechanics evolved with time. A key question is how Aristotelian mechanics, based on 'intuitive physics', eventually lost its influence. For example, Aristotle equated motion with force, but when Galileo and other Renaissance scientists started to experiment and build up a formal theoretical basis for mechanics, they began to realize his error.

The cupola project is already yielding insights. It has, for example, uncovered pay slips for two 'observers' who were paid to watch architect Filippo Brunelleschi building a model of the cupola, to prove it could be safely constructed without expensive scaffolding. "This says something about a point in time at which mechanical knowledge was moving forward to new feats which had not been tested," says Renn — who expects such



serendipitous connections to become more frequent when automated search tools have more information to sift.

Other sources include engineering drawings for machines, analysed according to their elementary building blocks; images from ballistic treatises, analysed for their reliance on theoretical or practical knowledge (seeing, for example, what the authors recommend as the best angle of 'throw'); and dimensions of artefacts such as balances and standard weights, together with video records of their production and use.

Expert input

Annotating these diverse sources of information will require intellectual input from scores of historians, together with experts of other disciplines. Collaborators include physicists, archaeologists and even cognitive psychologists — who are working with children to help develop a better understanding of intuitive physics.

Aside from enlisting expert knowledge and developing computational tools, the main problems facing Renn and his colleagues centre on access to source materials. Copyright can be a thorny problem and archivists, who tend to see themselves as guardians of historical treasures, are sometimes obstructive.

Renn's digital revolution has also met resistance from some academic historians.

Fritz Krafft, head of the Institute for the History of Pharmacy at Marburg University in Germany, worries that historians working on translations by computer from a language with which they are not familiar could be led to false interpretations. John Heilbron, a historian of science at the University of Oxford, also remains unconvinced by a brute-force informatics approach. "You need new ideas, not just new tools," he says.

But many are enthusiastic. "This is the way scholarship is going," says Seamus Ross, director of the Humanities Advanced Technology and Information Institute at Glasgow University. "This approach makes humanities more science-like, because of the ease of repeatability and testability of arguments against other interpretations." Rudiger vom Bruch, a historian of science at the Humboldt University in Berlin, agrees: "Historians would be badly advised if they didn't use the possibilities offered by digitization."

Some historians may fear that Renn's approach will rob their discipline of its romance. But once Archimedes and its successors bear fruit, he argues that such fears will prove unfounded. "On the contrary, it will revitalize the potential of the humanities to reflect upon our culture," he says. ■

Allison Abbott is Nature's senior European correspondent.

Cuneiform Digital Library Initiative

♦ <http://www.cdli.ucla.edu/index.html>

Galileo's *Notes on Motion*

♦ http://www.mpiwg-berlin.mpg.de/Galileo_Prototype/MAIN.HTM

Perseus Project

♦ <http://www.perseus.tufts.edu>