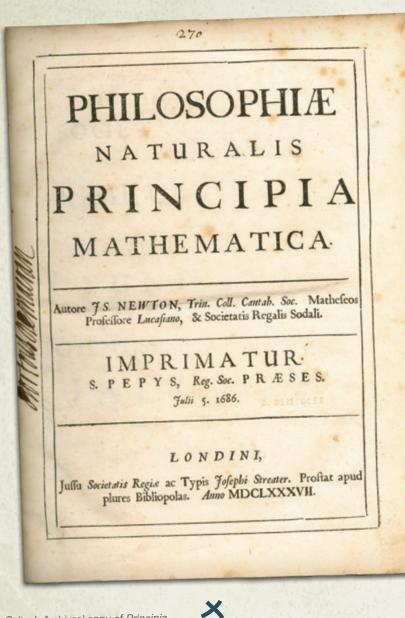
A GLOBAL TREASURE HUNT --



The Caltech Archives' copy of Principia is seen above; at right, is another copy located at The Huntington Library, in which Newton's own handwriting can be seen in the margins.

How a term paper on Newton's Principia led to a decade-long search for first-edition copies around the world.

by Whitney Clavin

n a story of lost and stolen books and scrupulous detective work across continents, two Caltech-affiliated historians recently made headlines with their discovery of hundreds of previously uncounted copies of Isaac Newton's groundbreaking science book Philosophiae Naturalis Principia Mathematica, known as the Principia.

"We felt like Sherlock Holmes," says Mordechai (Moti) Feingold, Caltech's Kate Van Nuys Page Professor of the

"We felt like Sherlock Holmes."

tracing copies of the book around the world. Feingold and Svorenčík, who is now at the University of Mannheim in Germany, are co-authors of a paper about the survey published in the journal Annals of Science.

The new census more than doubles the number of known copies of the famous first edition, published in 1687. The last census of this kind, published in 1953, had identified 189 copies, while the new Caltech survey finds 386 copies. Up to 200 additional copies, according to Feingold and Svorenčík, likely still exist undocumented in public and private collections.

From Slovakia to South Africa

The project was born out of a paper Svorenčík wrote for a course in the history of science taught by Feingold. Originally from Slovakia, Svorenčík had written a term paper about the distribution of the Principia in Central Europe. "I was interested in whether there were copies of the book that could be traced to my home region. The census done in the 1950s did not list any copies from Slovakia, the Czech Republic, Poland, or Hungary. This is understandable, as the census was done after the Iron Curtain descended, which made tracing copies very difficult."

To Svorenčík's surprise, he found many more copies than Feingold had expected. The summer after the class, Feingold suggested to Svorenčík that they turn his project into the first-ever complete, systematic search for copies of the first edition of the Principia. Their ensuing detective work across the globe turned up about 200 previously unidentified copies in 27 countries, including 35 copies in Central Europe, and others in such far-flung locales as the Vatican, South Africa, Norway, Ireland, and Japan.

Feingold and Svorenčík even came across lost or stolen copies of the masterpiece; for example, one copy found with a bookseller in Italy was discovered to have been stolen from a library in Germany half a century earlier.

History of Science and the Humanities, who, along with his former student Andrej Svorenčík (MS '08), spent more than a decade

"We contacted the German library to let them know, but they were too slow to make a decision to buy back the copy or apprehend it somehow, so it ended up back on the market," says Feingold.

A masterpiece, with a mystique

The primary person behind the book's publication was Edmond Halley, a well-known English scientist who made

several discoveries about our solar system, including the periodicity of what later became known as Halley's Comet. Feingold explains that, before the Principia was written, Halley had asked Newton for some calculations regarding elliptical orbits of bodies in our solar system. When Halley saw the calculations, "he got so excited, he rushed back to Cambridge and basically forced Newton to write the Principia," says Feingold. In fact, Halley funded the publication of the book's first edition.

In the Principia, Newton introduced the laws of motion and universal gravitation, "unifying the terrestrial and celestial worlds under a single law," says Svorenčík.

Soon after its publication. the book was recognized as a work of genius. "Because Halley had already prepared the public for what was to come," says Feingold, "there was a widespread recog-

nition that the Principia was a masterpiece." Later, a "mystique" about Newton started to develop, according to Feingold, exemplified in a story about two students walking in Cambridge and spotting Newton on the street. "There goes a man,' one of them said, 'who wrote a book that neither he nor anybody else understands," says Feingold.

"By the 18th century, Newtonian ideas transcended science itself," says Feingold. "People in other fields were hoping to find a similar single law to unify their own

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respective fields. The influence of Newton, just like that of Charles Darwin and Albert Einstein, exerted considerable influence on many other aspects of life, and that is what made him such a canonical figure during the 18th century and beyond."

Copies of the first edition of the Principia sell today for between \$300,000 and \$3,000,000 via auction houses like Christie's and Sotheby's as well as on the black market. Feingold and Svorenčík estimate that some 600, and possibly as many as 750, copies of the book's first edition were printed in 1687.

In the marains

By analyzing ownership marks and notes scribbled in the margins of some of the books, in addition to related letters and other documents, the researchers found evidence that the *Principia*, once thought to be reserved for only a select group of expert mathematicians, was more widely read and comprehended than previously thought.

"One of the realizations we've had," says Feingold, "is that the transmission of the book and its ideas was far quicker and more open than we assumed, and this will have implications on the future work that we and others will be doing on this subject."

"When you look through the copies themselves, you might find small notes or annotations that give you clues about how it was used," says Svorenčík, who has personally inspected about 10 percent of the copies documented in this new census. When traveling to conferences in different countries, he would make time to visit local libraries. "You look at the condition of the ownership marks, the binding, deterioration, printing differences, etc."

Even without inspecting the books up close, the historians could trace who owned them through library records and other letters and documents, and learn how copies were shared.

"It's harder to show how much people engaged with a book than simply owned it, but we can look at the notes in the margins and how the book was shared," says Feingold. "You can assume that for each copy, there are multiple readers. It's not like today, where you might buy a book and are the only one to read it. And then we can look for an exchange of ideas between the people sharing copies. You start to put together the pieces and solve the puzzle."

Svorenčík and Feingold hope that their census, which they call preliminary, will yield information about other existing copies tucked away with private owners, book dealers, and libraries. Continuing this line of research into the future, the historians plan to further refine our understanding of how the Principia shaped 18th-century science.

A copy in Prague belonged to Anton Ernst Burckhard von Birckenstein, a tutor to Leopold I, Holy Roman Emperor and the author of several geometry books. An elder courtier in Prague, the mathematician Ferdinand Ernst Karl, Graf von Herberstein, also owned a copy that was found in Graz, Austria. A third copy, owned by Herberstein's associate, Johan A. Graf von Schaffgotsch, who was also a mathematician, is currently preserved at the University of Arizona. The three mathematicians moved in the same circles and likely knew each other.

The Arizona copy ultimately got into the hands of Herbert McLean Evans, a famous collector in the states who. during his lifetime, owned five different copies. Every time he ran out of money, he had to sell his library. This copy got to the University of Arizona in the 1970s.

A copy that came up for auction at Sotheby's in London was discovered to have been stolen from a library at Edinburgh University. Feingold contacted the university, which put a stop to the sale. After several months, the university and the auction house reached an agreement, and the book came up for sale again and is now owned by a private collector in Greenwich, Connecticut.

The researchers found a copy owned by an English nobleman, Wriothesley Russell, 2nd Duke of Bedford. Feingold and Svorenčík discovered that the nobleman's tutor was Nicolas Fatio de Duillier, a good mathematician and friend of Newton. It seems the tutor taught the nobleman from Newton's book.

Feingold knows of one book that appears to have been destroyed. A French mathematician, Abraham de Moivre, as the story goes, came to England in 1687. He saw a copy in the house of his employer and got so excited about it that he bought himself a copy. But since he traveled so much for his work, he cut out the pages and carried one page of the book with him each time he went to give a lesson.

> Locations of newly found copies of the Principia

How to be a book detective

"Much of the information that we have is available on the title page or somewhere else in the book. When you have a name, sometimes it's a famous name, but sometimes it's an obscure figure. In those cases, we have to go and investigate who that person is. If a book was auctioned in the last several decades, the auction houses will try to ascertain the provenance of that book. But often, many earlier copies don't really have provenances, and one of the great difficulties that we have is to try to match books that we find in catalogs to present known copies. So it's a kind of detective work that is on several levels, and often lines of transmissions are not continuous but broken, and we have to try to fill in what happened in the interval between one owner to the next. It's kind of a continuous labor, a never-ending story." - Moti Fiengold

A copy from Uppsala was stolen in the late 1960s, then appeared at auction in Vienna in the early 1980s. Subsequently, it was bought at a Christie's auction in 2004 by a Swedish-American collector who returned it to Uppsala, where it was reunited with its original owner in 2009.



A copy offered for sale by an Italian bookseller was discovered to have been stolen from a German library half a century earlier, probably during WWII. The researchers let the library know, but they were too slow to buy back the copy or apprehend it, and it has disappeared again.

Feingold and Svorenčík are still looking for a copy in China. "I have a colleague in China, and I've written to him and he said, 'Yes, there is a copy in Beijing," says Feingold. "He sent someone to the library, and the answer came back, 'We can't find it."

Where in the World?

Number of copies • 1-9 • 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80-89