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Old sailing manuals reveal how sailors helped create a global view of Earth

EU-funded researchers have pored over centuries-old sailing manuals and ship logbooks to trace how sailors' hard-won knowledge slowly built our modern view of a connected planet.

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In September 1522, the first expedition to circumnavigate the globe finally returned home. Of the five ships and 270 men that had set sail three years earlier under the command of Portuguese explorer Ferdinand Magellan, only one vessel and 18 survivors completed the journey. Magellan himself was killed in the Philippines and never made it back.

Today, we take for granted that Earth is one interconnected planet. But that understanding did not emerge overnight. It was built gradually, voyage by voyage, as generations of sailors pieced together knowledge from oceans they had never crossed before.

Dr Henrique Leitão, a historian of science at the University of Lisbon, Portugal, has spent years exploring how navigation transformed scientific understanding during the 15th to 17th centuries, a period known as the Age of Discovery. In 2019, he launched the six-year EU-funded RUTTER project to investigate how practical maritime knowledge gradually reshaped the way people understood the world.

“Today, we immediately think of Earth as a single coherent object,” said Leitão. “But if you look at the picture hundreds of years ago, views of the world were very local. There has always been the question of exactly how and when we came to form this wider idea of a global Earth.”

Charting hidden sources

Leitão’s team of researchers at the University of Lisbon followed a very different route to their historic compatriot. Instead of voyaging across oceans, they spent six years navigating centuries-old sailing records called “rutters” to uncover how those voyages contributed to humanity’s changing understanding of the planet.

Alongside ships’ logbooks, rutters recorded the practical information sailors needed for ocean navigation at the time, from distances, latitudes, currents, winds and storms to details of Earth’s magnetism and natural features.

These largely overlooked documents turned out to be a treasure trove, said Leitão. Although rutters were never intended as travel narratives – and can appear, as Leitão jokingly puts it, “super boring” – they turned out to be an extraordinary scientific resource.

The researchers examined hundreds of these documents from the 15th to the 17th centuries in archives across Portugal, Spain and elsewhere, while also compiling an extensive catalogue of surviving navigational material for future historians.

Building a global Earth

The researchers uncovered how the idea of a connected, global Earth emerged gradually through repeated long-distance voyages and the steady accumulation of practical observations.

The earliest surviving rutters, written in the late 15th century, were relatively rough and rudimentary. Over time, they became increasingly detailed, recording more precise measurements that could be compared between voyages.

As these observations accumulated, sailors, navigators and cartographers gradually began recognising patterns that extended far beyond local waters.

“By the late 16th century, there was more of an understanding of how the winds and sea currents moved across Earth and a growing concept of global climate,” said Leitão. “It was understood that climate was broadly one particular way in the Southern Hemisphere and another in the Indian Ocean, for example. Cartography focused more on the whole Earth, too.”

What distinguishes the RUTTER project is the scale of its analysis. Rather than studying individual manuscripts in isolation, the researchers systematically compared large collections of rutters and logbooks to trace how maritime knowledge circulated between different sailors, regions and navigational traditions.

Their work brought together historians from several countries and fostered collaborations with researchers worldwide to compare maritime traditions across different cultures.

As long-distance voyages became more reliable, increasing numbers of people crossed oceans, gradually bringing distant parts of the world, and their knowledge, closer together.

The influence of this new maritime knowledge extended far beyond ships. The RUTTER researchers also investigated the navigators who wrote and used the rutters, examining how they were trained, the skills they possessed and the surprisingly important intellectual role they played.

They also found evidence of how these ideas filtered into Portuguese literature, theatre and wider intellectual life, expanding society's understanding of the world we live in.

Knowledge without borders

Dr Juan Acevedo, a historian of science at the University of Lisbon and a member of the RUTTER team, believes another important lesson is that Europe's growing understanding of the world depended heavily on knowledge shared by local sailors.

He points to 1565 as a turning point. That year, Spanish ships finally succeeded in establishing a return route across the Pacific from the Philippines to Mexico by learning how to exploit seasonal winds and ocean currents.

"Before that, there had been unsuccessful attempts to sail back to the Americas via that route," said Acevedo. "Then, in 1565, they nailed it using the right current and wind patterns. After that, it was a highway for 260 years."

He compares rutters to cookbooks.

"Like a cookbook that says 'add a pinch of this, add a pinch of that, and cook for this amount of time', rutters say: 'head this way until you see this feature, then go that way'."

Acevedo also examined Arabic sources on Indian Ocean navigation, revealing extensive exchanges between European sailors and local navigators.

"Every step of the way, Europeans were interacting with locals and getting help from them," he said.

For both Acevedo and Leitão, this challenges the traditional image of scientific progress being driven solely by great thinkers or famous explorers.

"It also shows how crucial contact with local knowledge was for the evolution of modern science," said Acevedo.

Lessons for today

Five centuries later, these practical sailing records are proving valuable for far more than understanding the history of navigation.

Because sailors routinely noted the wildlife they encountered, the documents could help researchers reconstruct past marine biodiversity. They also contain observations of weather and sea conditions that may provide valuable historical data for climate research – an idea Leitão is already exploring in separate research examining 19th-century ships' logbooks.

Yet perhaps the biggest lesson from the RUTTER research is about how knowledge itself develops.

Rather than emerging solely from universities or royal courts, our modern understanding of the world grew from countless practical observations made by ordinary sailors, then shared, refined and passed on from one generation to the next.

“A big question that always puzzles science historians is how science moves forward,” said Leitão. “Our research shows that it is often shaped by the multiple actions of ordinary people.”

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