

Maps, coordinates and the representation of space

Juan Segurola

Core question

What changes when places are represented not only by routes and landmarks but by positions in an abstract coordinate space?

Historical and evolutionary context

Human communities mapped environments long before mathematical cartography. Route knowledge, coastal profiles, itineraries, cadastral records and Indigenous spatial traditions encoded relations that were often more useful for travel than a geometrically uniform map. The major epistemic transition was therefore not “the invention of maps,” but the addition of reproducible coordinate frameworks to older spatial knowledge.

Ptolemy's second-century *Geography* described a world through latitude and longitude and explained how a spherical Earth could be projected onto a plane. Its coordinates were imperfect and its geography contained major distortions, but the method separated a spatial model from any single drawing: in principle, a map could be reconstructed from numerical positions. Geographic coordinate data also circulated through Arabic and medieval Latin traditions before the work's celebrated Renaissance reception.

Jacopo Angeli translated Ptolemy's *Geography* into Latin around 1406-1410. Printed Latin editions appeared in 1475 and 1477, the latter with maps. In fifteenth-century Europe, the recovery of Ptolemy's *Geography* interacted with portolan practice, surveying, navigation, urban measurement and new printing technologies. This was not a simple revival of an ancient system. Renaissance cartographers modified projections, combined incompatible sources and gradually created maps that could be updated as new voyages supplied new information. Mercator's 1569 world map later made a new projection central to long-distance navigation and cartographic debate.

What could communities know before this transition?

Routes, boundaries and landmarks could be known with high practical precision without being embedded in a universal coordinate grid. Local navigation could be excellent while global spatial integration remained difficult.

What changed?

Locations became comparable within a common mathematical frame. A coordinate can be copied, recalculated and combined with other coordinates. Errors also become visible as discrepancies between measurements and mapped positions.

Why could this capability emerge?

Astronomical methods, geometry, surveying, navigation, manuscript transmission and later print all contributed. No single culture supplied the entire package. Coordinate geography was repeatedly reconstructed from multiple observational and textual traditions.

What later forms of knowledge did it enable?

Mathematical mapping supported navigation, state administration, geodesy and eventually global reference systems. It also made space computational: positions could be transformed, projected and compared rather than merely described.

New limits and risks

A grid can conceal uncertainty. Coordinates may appear exact even when observations are poor. Maps also serve power: states can use standardised spatial representation for taxation, military control, colonisation and boundary-making.

What changed in the architecture of knowledge?

Spatial knowledge became increasingly **portable, combinable and recalculable**. A place could be represented as data within a shared frame rather than only as lived route knowledge.

Loss, exclusion and uncertainty

Coordinate cartography did not make non-coordinate traditions obsolete. Polynesian wayfinding, Indigenous landscape knowledge and route-based maps often encoded environmental relations poorly captured by geometric grids. The epistemic gain was interoperability, not universal superiority.

Dependency map

- INDIRECT ← PIO-021 Roads, logistics and organised information
- INDIRECT ← PIO-026 Eratosthenes and the size of Earth
- INDIRECT ← PIO-035 Al-Biruni and geodesy
- INDIRECT ← PIO-038 Chinese engineering, compass and gunpowder traditions
- PARALLEL ← PIO-039 Polynesian and Indigenous wayfinding
- INDIRECT → PIO-044 Renaissance humanism, perspective and printing
- INDIRECT → PIO-047 Tycho Brahe and precision observation

References

1. Berggren, J. L. & Jones, A. *Ptolemy's Geography: An Annotated Translation of the Theoretical Chapters*. Princeton University Press (2020). DOI: 10.2307/j.ctv10h9d98.
2. Defaux, O. *The Iberian Peninsula in Ptolemy's Geography: Origins of the Coordinates and Textual History*. Edition Topoi (2017). DOI: 10.17171/3-51.
3. Nothaft, C. P. E. "A Thirteenth-Century Latin List of Ptolemaic Coordinates." *Mediterranea. International Journal on the Transfer of Knowledge* 7, 1-15 (2022). DOI: 10.21071/mijtk.v7i.13608.