

HISTORY COURSE

History of Maps and Cartography

From clay tablets to satellites: how maps are made, and how to read them.

10 Chapters

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Generated with Claude

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History of Maps and Cartography

Course 1 · Chapter 1 · Why Maps? Scope & Sources

A map looks like a picture of the world, but it is better described as an argument about it. Every map leaves things out, chooses a scale, picks a viewpoint and decides what counts as worth showing. This first chapter asks what a map is, looks at the earliest surviving examples and at non-European traditions, and sets out how the course will treat the many "firsts" and myths that surround the history of mapping. Names and dates are from general knowledge and flagged "check".

What Is a Map?

A model, not a copy

A map is a simplified model of a place, made for a purpose. A road map, a geological map and a tourist sketch of the same city differ because they answer different questions (check the examples you meet).

Four choices

Every map involves a **scale** (how much is shown), **symbols** (what marks stand for), an **orientation** (which way is up) and a **projection** if it shows a curved Earth on a flat sheet (Chapter 5).

North is a convention

Placing north at the top is a habit that became standard in Europe, not a law. Medieval European maps often put east at the top, and many maps from other traditions use other orientations (check examples; see Chapter 3).

The Earliest Maps

Object (check each)	Note
Çatalhöyük wall painting, about 6000	A painting from a Neolithic town in Anatolia has been called the oldest map, as a plan of the town with a volcano behind. Many scholars doubt

Object (check each)	Note
BC	that it is a map at all (check the debate).
Mammoth-tusk carving from Mezhyrich, Ukraine	Ice Age carvings have been interpreted as plans of settlements or rivers. These readings are possible but unproven (check).
Turin Papyrus, about 1150 BC	An Egyptian drawing of a gold-mining area in the eastern desert, often called the oldest surviving map with a clear practical purpose (check the date).
The Babylonian "world map", about 600 BC	A clay tablet in the British Museum shows a circular world with Babylon at the centre, surrounded by water, with accompanying cuneiform text (check). It is often called the oldest known world map.
Chinese maps from Fangmatan, third century BC	Maps drawn on wooden boards found in a tomb in Gansu, among the oldest known Chinese maps (check).

"Oldest map" claims

The title of "oldest map" depends on what counts as a map, and many claims rest on interpretation. A careful statement names the object, the date range, the museum or site that holds it, and the reason scholars read it as a map. Where scholars disagree, say so. This habit of marking what is documented, claimed or unknown runs through the whole course.

Other Ways of Mapping

- **Marshall Islands stick charts.** Navigators made charts from sticks and shells showing the pattern of ocean swells around islands, used to teach rather than carried at sea (check how they were used).
- **Inuit coastal carvings.** Wooden carvings from East Greenland show coastlines that can be read by touch, even in the dark or on a boat (check the history of the collection).
- **Songlines and oral maps.** Some Aboriginal Australian traditions record routes and landmarks in songs and stories (check; this is a cultural practice, and sources should come from the communities and scholars who work with them).
- **The lesson.** Maps need not be drawn on paper. A map is any tool that records spatial knowledge for others to use.

Scope of the Course

Part (check)	Chapters	Topics
Ancient and medieval maps	2, 3	Greek geographers, Ptolemy, Roman roads, mappae mundi, portolan charts, Islamic mapmakers
Print, discovery and projection	4, 5	Waldseemüller, Mercator, Ortelius, how to flatten a sphere
Surveying and the sea	6, 7	National surveys, the Ordnance Survey, charts and longitude
Maps as argument and the digital age	8, 9	Thematic maps, the London Underground map, propaganda, satellites, GPS, web maps
Capstone	10	The map is not the territory

The course is global in outline and keeps to Europe, the Islamic world and the British Isles for most of its detail. It covers key maps and the arguments about them, not every atlas.

Myths to Test

Common claim	The question a careful reader asks (check each)
Medieval people thought the Earth was flat.	What did educated medieval writers actually say about the shape of the Earth? (Chapter 3)
Columbus proved the Earth was round.	What was known before 1492, and what was disputed? (Chapter 4)
The Mercator map is "wrong".	For what purpose was it designed, and what does it distort? (Chapter 5)
Old maps showed sea monsters because people believed in them.	What were monsters used for on maps? (Chapters 3 and 4)
John Snow's map ended cholera.	What did the map show, and what did it not do? (Chapter 8)
Satellites made maps neutral.	Who decides what a digital map shows? (Chapter 9)

Sources to Use

- **Libraries and museums,** such as the British Library, the National Library of Scotland map collection with its online map viewer, and the Library of Congress (check names and what is online).
- **Scholarly histories,** notably the multivolume *History of Cartography* series, much of it available online (check).
- **The maps themselves,** read closely: who made them, for whom, when and with what source.
- **Surveying and mapping agencies,** whose histories explain how national maps were made (check which are available).

A British comparison

The Ordnance Survey and the many town and county maps in the National Library of Scotland and the British Library mean that British readers can look at their own district across three centuries, which makes local map history unusually easy to study. A walk with an Ordnance Survey map is also the quickest way to see scale, symbols and orientation at work.

Check the details

Every name, date and attribution in this course comes from general knowledge and is marked "check" where it is uncertain. "First" and "oldest" claims in particular should be verified with the holding museum or a scholarly source before they are repeated.

Exercises

EXERCISE 1

Choose a map you know (a road map, a tube map, a school atlas page) and list what it shows, what it leaves out, its scale, its symbols and its orientation.

→ Solution

EXERCISE 2

Choose one "oldest map" claim from the table and write a short plan for testing it: what evidence you would look for and where.

→ Solution

EXERCISE 3

Explain why the Marshall Islands stick charts and an Ordnance Survey sheet are both maps, and what they have in common.

→ Solution

Quick Reference

- **A map:** a purposeful model with scale, symbols, orientation and projection
- **Earliest:** Egyptian mining map, Babylonian world map, early Chinese maps (check)
- **Other forms:** stick charts, carved coasts, songlines
- **Method:** mark what is documented, claimed or unknown
- **The caution:** "oldest" and "first" claims rest on definitions

History of Maps and Cartography

Course 1 · Chapter 2 · Greek Mapmakers and Ptolemy

Greek writers turned the map into a thing that could be argued over with geometry. They reasoned that the Earth is a sphere, measured it, and proposed ways to fix any place by numbers. None of their original maps survive, so what we know comes from later descriptions and copies, a point to keep in mind throughout. Names and dates are from general knowledge and flagged "check".

From Cosmology to Geography

Anaximander

A sixth-century BC thinker from Miletus is credited by later writers with drawing an early map of the world and with a model of the cosmos (check; the attribution rests on later sources).

Herodotus

In the fifth century BC he mocked maps that showed a perfectly round world with Ocean running round it, which tells us such maps were circulating (check the passage).

A spherical Earth

By the time of Aristotle in the fourth century BC the argument for a sphere rested on evidence such as the Earth's curved shadow in lunar eclipses and the changing stars seen when travelling north or south (check).

Measuring the Earth

Figure (check each)	Contribution
Pytheas of Massalia, fourth century BC	A voyager who reported a journey into the north Atlantic, with observations of the sun's height, which were used by later geographers. His own text is lost and his reliability was disputed in antiquity (check).

Figure (check each)	Contribution
Eratosthenes of Cyrene, third century BC	Librarian at Alexandria, said to have estimated the Earth's circumference by comparing the sun's angle at two Egyptian places, Syene and Alexandria, a distance known by travel time. The units he used (stadia) are uncertain, so the accuracy of the result is debated (check).
Hipparchus, second century BC	Proposed fixing places by latitude and longitude drawn from astronomical observations (check what is attributed to him and what came later).
Strabo, about 20 AD	Wrote a long *Geography* describing the known world, which includes a critique of earlier geographers (check).

Reasoning, not instruments

The method of Eratosthenes needed only a shadow, a known distance and some geometry. What the Greeks lacked was a way to measure longitude, the east-west position, which needs accurate timekeeping or shared astronomical events. For many centuries this made the east-west scale of maps much less reliable than the north-south scale (check; Chapter 7 returns to the problem).

Ptolemy and the *Geography*

- **Who.** Claudius Ptolemy worked in Alexandria in the second century AD, and also wrote the astronomical *Almagest* (check).
- **What.** His *Geography* gives instructions for drawing maps and a list of places with their coordinates, thousands of them (check the number).
- **Projections.** He discussed ways of drawing a curved Earth on a flat sheet, which is the problem of Chapter 5.
- **Problems.** His coordinates were often wrong, and he used a smaller Earth than Eratosthenes, which made Asia seem to stretch further east. That error mattered later (check; see Chapter 4).
- **Maps.** The maps that accompany the text in surviving manuscripts are copies from many centuries later, and it is debated how far they reflect his own (check).

Idea	Why it mattered (check)
Coordinates for places	A map could be rebuilt from a list of numbers, and corrected place by place.
A grid of meridians and parallels	Gave a shared frame for comparing information from different sources.
Instructions for projections	Made map-making a craft with rules that others could learn.
Authority	Because the text was so thorough, later users sometimes trusted it over newer information.

What Survived and How

- **Loss.** No Greek map of the classical period survives in the original. We rely on descriptions and on later copies (check).
- **Transmission.** Ptolemy's work was studied in the Byzantine and Islamic worlds, and reached Latin Europe in the early fifteenth century, when it was translated and printed within decades (check dates; Chapter 4).
- **A caution.** A "Ptolemaic map" drawn in 1480 is a Renaissance reconstruction from his text, not a map he drew.

A British comparison

Ptolemy lists a Britain that is rotated, with Scotland bent to run east-west, a mistake that appears on printed maps as late as the sixteenth century (check). It is a handy example of how an authoritative error persists until a new survey replaces it, which Chapter 6 shows for Scotland itself.

Check the details

Eratosthenes' figures depend on the length of a stadion, and the "very accurate" claim often repeated needs care. Attributions to Anaximander and Hipparchus rest on later writers. Check the sources before quoting any number.

Exercises

EXERCISE 1

Explain in your own words how Eratosthenes' method works, and list the assumptions it relies on.

→ Solution

EXERCISE 2

Why is it misleading to speak of "Ptolemy's map of the world"? Write a more careful sentence.

→ Solution

EXERCISE 3

Explain why an error in the size of the Earth could change a plan for a voyage.

→ Solution

Quick Reference

- **Eratosthenes:** measured the Earth by shadow angles (units uncertain)
- **Hipparchus:** latitude and longitude from astronomy
- **Ptolemy:** *Geography*, coordinates and projections
- **Survival:** originals lost, later copies and reconstructions
- **Weak point:** longitude, and a too-small Earth

History of Maps and Cartography

Course 1 · Chapter 3 · Roman and Medieval Maps

Between the end of the Roman Empire and the age of print, several kinds of map lived side by side, each made for a different purpose. Some showed the road to a place, some showed the whole of sacred history, some helped a sailor find a harbour, and some gathered the learning of scholars in Baghdad, Cairo and Palermo. This chapter sets them side by side and tests the popular idea that people in the Middle Ages believed the Earth was flat. Names and dates are from general knowledge and flagged "check".

Four Kinds of Map

Itineraries

Maps or lists that show the way from place to place. The Peutinger Table is a long, narrow Roman-style road map, known from a medieval copy (check the date of the original and the copy).

Mappae mundi

"Cloths of the world": large pictures of history and belief as much as of geography, often with Jerusalem at the centre and east at the top (check).

Portolan charts

Sea charts of the Mediterranean and Black Sea, covered in lines radiating from compass points, with port names written inland at right angles to the coast (check).

Scholarly world maps

Maps by Islamic geographers drawn with coordinates and with sources, often combining Ptolemy with travellers' reports (check).

Roman Itineraries

- **The Peutinger Table.** A long strip showing roads, towns and distances, stretched so that Britain, Europe and Asia run across a long page. It is a copy made around the thirteenth century of an older original (check).
- **Purpose.** It shows connections and distances, not true shape, like a modern transport diagram.

- **The lesson.** A map that gets shapes wrong may still do its job. Chapter 8 returns to this.

Mappae Mundi

Feature (check each)	Detail
The Hereford Mappa Mundi, about 1300	A large map on vellum, kept at Hereford Cathedral, with Jerusalem near the centre, east at the top, and many scenes from the Bible, classical stories and travellers' tales.
Purpose	To show the place of the world in sacred history and to teach, not to guide a traveller.
Monsters and wonders	Drawn from classical and early Christian authors, they marked the edges of the known world, and were drawn for meaning, not as sailing directions.
Other examples	The Ebstorf map, destroyed in the Second World War, and smaller maps in manuscripts (check).

The flat-Earth myth

Educated medieval writers generally described the Earth as a sphere, and this was standard teaching in the schools. The idea that medieval people believed in a flat Earth, and that Columbus proved otherwise, was spread mainly in the nineteenth century (check the history of the myth and the names usually linked with it). The circular form of a mappa mundi is a diagram of the habitable world, not a claim about the shape of the planet.

Portolan Charts

- **Appearance.** Coastlines drawn with remarkable accuracy for the Mediterranean, with a web of straight lines from compass roses (check).
- **Use.** Probably aids for sailors to plan a course by compass direction and estimated distance, though how they were used on board is debated (check).
- **Earliest.** The Carta Pisana, around 1300, is often named as the oldest surviving example (check).

- **Material.** Drawn on animal skin and made to last, suggesting that they were also valuable objects (check).
- **The Catalan Atlas,** 1375, combines portolan coasts with a picture of the wider world, including Africa and Asia (check).

Islamic Geography

Figure (check each)	Contribution
Al-Khwarizmi, ninth century	Produced a work on the "picture of the earth" with coordinates, partly based on Ptolemy.
Al-Biruni, about 1000	Wrote on geodesy and on the determination of positions and the Earth's size.
Al-Idrisi, twelfth century	Worked for the Norman king Roger II of Sicily on a silver planisphere and a book of descriptions. His maps in the book often put south at the top (check).
Piri Reis, 1513	An Ottoman admiral whose world map, partly surviving, drew on many sources including Columbus. Popular claims that it shows Antarctica are not supported by scholars (check).

A British comparison

The Hereford map is an hour's journey from many parts of Britain and can be visited, together with the cathedral's chained library. Seeing it in person is a good way to understand that a map can be a statement of belief as much as a guide for travellers. The surviving Gough Map of Britain, about 1360, is by contrast a route map of roads and towns (check the date).

Check the details

Dates for medieval maps are approximate, and attributions are often disputed. Claims about Piri Reis and "lost knowledge" should be tested against scholarly sources, and be treated with caution if they cite no evidence.

Exercises

EXERCISE 1

Make a table comparing the four kinds of map by purpose, user, accuracy and style of drawing.

→ Solution

EXERCISE 2

Write a short answer to someone who says that medieval people believed the Earth was flat, using what mappae mundi show.

→ Solution

EXERCISE 3

Explain why east was at the top on many maps, and why we say "orient" for finding our bearings.

→ Solution

Quick Reference

- **Itinerary:** Peutinger Table, roads and distances
- **Mappa mundi:** Hereford, sacred history, east at the top
- **Portolan chart:** Mediterranean coasts, compass lines
- **Islamic geography:** al-Idrisi, coordinates, sources
- **The myth:** the flat Earth is a later invention

History of Maps and Cartography

Course 1 · Chapter 4 · Printing and the Age of Discovery

Printing changed maps from rare, hand-copied objects into things that could be made in hundreds of copies and corrected edition by edition. At the same time, voyages across the Atlantic and Indian Oceans sent a flood of new information back to Europe, and mapmakers had to decide how much of it to believe. This chapter follows the new maps, the first use of the name "America", and the Dutch atlases of the late sixteenth and seventeenth centuries. Names and dates are from general knowledge and flagged "check".

Ptolemy in Print

Translation

A Latin translation of Ptolemy's *Geography* was made in Italy in the early fifteenth century (check), bringing the idea of coordinates back to Latin Europe.

First printed editions

Printed editions with maps appeared in the 1470s, in Bologna and Rome, and later in Ulm, which was among the first to use woodcuts, while engraved plates were used in Italy (check the order).

New maps added

Later editions added "modern maps" of regions the ancient text did not describe, a sign that Ptolemy was becoming a starting point, not the last word (check).

Naming America

Item (check each)	Detail
Columbus, 1492	Sailed west from Spain expecting to reach Asia. Educated people already knew the Earth was round, and the dispute was over its size. Columbus argued for a smaller Earth than most scholars (check).

Item (check each)	Detail
Waldseemüller map, 1507	A large printed world map made in the Duchy of Lorraine (at Saint-Dié) with the name "America" placed on the southern continent, after Amerigo Vespucci's first name (check).
Library of Congress	The one surviving copy of the 1507 wall map is held by the Library of Congress in Washington (check).
Later change	Waldseemüller dropped the name from his later maps, but by then it had spread (check).

Not a new world map in one step

Maps of the Americas were revised again and again as voyages added coastlines, and as pilots' secret charts were copied, bought and sometimes stolen. States such as Portugal and Spain kept master charts, the padrón real in Spain, and tried to restrict who saw them (check names). The new picture of the world came from competing reports, not a single survey.

Mercator, Ortelius and the Atlas

- **Gerard Mercator** (1512–1594), a Flemish mapmaker, made a world map in 1569 on a new projection for navigators (Chapter 5), and also gave the word "atlas" to a bound collection of maps, published after his death (check).
- **Abraham Ortelius** published the *Theatrum Orbis Terrarum* in 1570, often called the first modern atlas, with maps of uniform size, each backed by a list of sources (check).
- **Blaeu family.** Dutch publishers in Amsterdam in the seventeenth century produced very large, richly decorated atlases (check).
- **Hondius, Jansson and others** competed in the same market, and plates were sold, reused and copied (check).
- **The business.** An atlas was a prestige object as well as a reference work, and a map's decoration could help to sell it.

What Changed

Before print	After print (check)
Each copy drawn by hand, with copying errors	Identical copies from one plate, with corrections made in new states of the plate
Few readers saw a map	Merchants, officials and the educated public could own one
A map stayed with its maker's authority	A printed map carried a publisher's name and was open to criticism
Secrecy was easier to keep	Publication spread knowledge and made secrets harder to keep

For the voyages themselves, see the course *The Age of Exploration*. This course keeps to the maps those voyages produced.

A British comparison

Christopher Saxton's county maps of England and Wales, surveyed in the 1570s and published as an atlas in 1579, are an early national atlas in Britain, and are often described as the first of their kind for the country (check). John Speed's later county maps are widely reproduced and are probably the old maps most Britons have seen on a wall.

Check the details

The story that Columbus "proved the Earth was round" is a myth: the debate concerned the distance to Asia. Details of who first used a name or a technique on a map are often disputed, so verify claims about "firsts" with the holding library.

Exercises

EXERCISE 1

Explain how the disagreement over the Earth's size shaped the case for Columbus's voyage.

→ Solution

EXERCISE 2

List three ways that printing changed what a map could do, and one thing that stayed the same.

→ Solution

EXERCISE 3

Choose an old county map of your own area, from a library's online collection, and list what it shows, what it copies from earlier maps and what appears to be new.

→ Solution

Quick Reference

- **Print:** Ptolemy in the 1470s, many copies, corrections
- **1507:** Waldseemüller map names America (check)
- **Atlas:** Ortelius 1570, Mercator's collection, Blaeu
- **Britain:** Saxton 1579, Speed
- **Debate:** the size of the Earth, not its shape

History of Maps and Cartography

Course 1 · Chapter 5 · Mercator and Map Projections

A sphere cannot be flattened without stretching, tearing or squashing something, a fact proved in the nineteenth century by Gauss (check). Every flat map of the world is therefore a compromise, and a projection is a rule for choosing which distortions to accept. This chapter explains what Mercator's famous map was designed to do, what its critics say, and how other projections trade one kind of accuracy for another. Names and dates are from general knowledge and flagged "check".

The Problem

Orange peel

Peel an orange and try to press the skin flat: it splits or stretches. A map projection is a mathematical way of doing the same job with rules.

Four properties

A projection can try to keep **shape** (locally), **area**, **distance** or **direction**, but no flat map keeps all of them for the whole world (check).

Three families

Maps can be projected as if onto a cylinder, a cone or a flat plane. The shape of the surface and where it touches the globe decide where the distortion is smallest (check).

Mercator's Projection

- **Date.** Gerard Mercator published his world map in 1569 (check).
- **The aim.** A line of constant compass bearing, a rhumb line, appears as a straight line, which helps a navigator plot a course with a ruler and a compass (check).
- **The cost.** Areas grow larger towards the poles. Greenland looks as large as Africa, though Africa is about fourteen times larger (check the ratio).

- **The use.** It is a navigator's chart, and was never designed as a wall map of the world's countries, though that is how it was used for centuries.
- **Web maps.** A close relative, Web Mercator, is used by many online maps, because it keeps shapes right at city scale (check; Chapter 9).

Projection (check each)	Keeps	Distorts
Mercator, 1569	Local shapes and compass bearings	Area, strongly near the poles
Gall–Peters (equal-area), 1855 and 1973	Area	Shape; countries look stretched near the equator
Mollweide, 1805	Area	Shape near the edges
Robinson, 1963	A pleasing look, a compromise	Everything a little; not strictly equal area or conformal
Winkel tripel, 1921	A compromise of area, distance and angle	Everything a little; adopted by National Geographic in 1998
Azimuthal equidistant	Distances and directions from the centre point	Shape and area far from the centre

The Peters argument

In 1973 Arno Peters presented an equal-area map as a fairer picture of the world, and argued that Mercator's maps had favoured Europe. The projection had been described earlier by James Gall (check). Map scholars criticised the claims of novelty, and the stretched shape. The argument is useful because both sides were right about something: area matters for fair comparison, and no projection is neutral.

Choosing a Projection

Task	A sensible choice (check)
Plotting a compass course	Mercator
Comparing areas, such as population density	An equal-area projection
A general wall map	A compromise projection such as Winkel tripel

Task	A sensible choice (check)
Flight routes	A globe, or a map in which great circles appear straight, such as a gnomonic projection
Local survey maps	A projection fitted to the region, such as the Transverse Mercator on which the British National Grid is based

A British comparison

The Ordnance Survey uses a Transverse Mercator projection for the British National Grid, which is why a grid reference such as NT 25 73 gives a position on every OS map (check the example). A projection chosen for one small region distorts little there, and would distort badly if stretched across the world.

Check the details

Claims that a projection "is wrong" or "tells the truth" need to say for which purpose. Check numbers such as area ratios and the dates and attributions of projections before quoting them.

Exercises

EXERCISE 1

Explain why Greenland looks so large on a Mercator map, and what Mercator's design was meant to achieve.

→ Solution

EXERCISE 2

Choose a projection for each of three tasks (a sailing course, a map of population density, a wall map for a school) and give a reason.

→ Solution

EXERCISE 3

Use an orange peel, a globe or a free online tool that compares projections, and write three observations about distortion.

→ Solution

Quick Reference

- **No perfect map:** a sphere cannot be flattened without distortion
- **Mercator:** straight compass lines, inflated polar areas
- **Equal-area:** true size, stretched shape
- **Compromise:** Robinson, Winkel tripel
- **Rule:** choose the projection to fit the task

History of Maps and Cartography

Course 1 · Chapter 6 · Surveying the Nation

Until the eighteenth century most maps of a country were built from older maps, local knowledge and reports. Then states began to pay for measured surveys of their whole territory, using triangulation, a chain of precisely measured triangles, to make a framework on which detail could be hung. The map became an instrument of government, defence and taxation. This chapter looks at France, Scotland, the Ordnance Survey and India. Names and dates are from general knowledge and flagged "check".

How Triangulation Works

A baseline

Surveyors measure one length very carefully on level ground, often with chains or rods (check the methods used in each survey).

Angles

From each end of the baseline they measure the angles to a distant point, which fixes the triangle. The new side becomes the base of the next triangle, and so on across the land.

Detail

Once the framework is fixed, surveyors fill in roads, rivers, buildings and relief within it, working with smaller measurements. Errors are checked by closing the network.

Four Surveys

Survey (check each)	Detail
The Cassini family map of France, 18th century	A multi-generation project, begun under Louis XV, that produced the first map of a whole large country based on triangulation. The work showed that the Earth is slightly flattened at the poles, which was a scientific argument at the time (check).

Survey (check each)	Detail
The Military Survey of Scotland, 1747–1755	Directed by William Roy after the Jacobite rising of 1745, it mapped the Highlands and much of the Lowlands for the army. The "Roy map" was not published in his time, and is a manuscript now held by the British Library, with a digital version online (check).
The Ordnance Survey, from 1791	Founded as a military body, in the Board of Ordnance, and began with a baseline on Hounslow Heath, measured under Roy's plans. Its first map was of Kent, published in 1801 (check).
The Great Trigonometrical Survey of India, from 1802	Began under William Lambton and continued under George Everest, a vast chain of triangles across the subcontinent, used for administration and as a basis for measuring the height of the Himalaya (check).

Maps and power

These surveys were paid for by states for reasons of defence, tax, land ownership and control. Roy's survey followed a rebellion, and the Great Trigonometrical Survey served a colonial government. The maps were also scientific achievements. Both statements are true and a good history keeps them together.

The Ordnance Survey

- **Scales.** It mapped Britain at a series of scales, and the "one-inch" maps became the best-known (check the history of scales and the later switch to metric).
- **The "Battle of the Scales."** In the 1820s and after, there was a dispute over which scales to use in Ireland and Scotland, in which cost, accuracy and uses of land records were weighed against each other (check).
- **The Ireland survey,** from the 1820s, produced detailed six-inch maps and a record of place names (check).
- **Heights.** Bench marks cut into stone record heights above a sea-level datum, and many can still be found on old buildings (check).
- **Today.** The agency is now Ordnance Survey, a government-owned company, and supplies both paper and digital maps (check its current status).

Scotland, India and Everest

Item	Note (check each)
Roy's map	Drawn at a scale of about 1 inch to 1000 yards and coloured by hand, it shows farm buildings, fields, roads and hills in detail.
George Everest	Surveyor General of India from 1830 to 1843. The mountain was named after him in 1865, although he is said to have objected to the idea (check the story).
Local surveyors	Much fieldwork depended on Indian surveyors and assistants, some of whom trained for secret surveys across the border. Their contribution was long under-credited (check).
Place names	Surveyors recorded names from local informants, which sometimes created errors or standardised spellings.

A British comparison

The National Library of Scotland's online maps let a reader compare Roy's survey with the Ordnance Survey and with a present-day map of the same ground, so that a place in the Highlands or the Pentlands can be traced across 270 years. Edinburgh readers can often see what has changed by comparing the same square on each (check what is on the site).

Check the details

Check dates, scales and the order of events in each survey. The story that Everest disliked the naming and the details of his career should be checked with an authoritative source.

Exercises

EXERCISE 1

Explain triangulation as if to a friend who has never heard of it, with a diagram you can describe in words.

→ Solution

EXERCISE 2

Compare the purposes of Roy's survey and the Great Trigonometrical Survey. What did the maps' patrons want, and who gained?

→ Solution

EXERCISE 3

Using an online map library, compare one square kilometre of your area on an old Ordnance Survey sheet and on a modern map, and list five changes.

→ Solution

Quick Reference

- **Triangulation:** baseline plus angles, then detail
- **France:** Cassini map, first national triangulation (check)
- **Scotland:** Roy's Military Survey, 1747–1755
- **Britain:** Ordnance Survey from 1791
- **India:** Great Trigonometrical Survey, Everest

History of Maps and Cartography

Course 1 · Chapter 7 · Charts, Longitude and the Sea

A map for the land shows where things are, and a chart for the sea shows where it is safe to go. Charts carry soundings, rocks, tides and lights, and a mistake can wreck a ship. Their history is tied to a famous problem, how to know your east-west position at sea, whose solution depended on clocks as much as on stars. Names and dates are from general knowledge and flagged "check".

What a Chart Shows

Depths

Soundings, measured with a lead line, give the depth at points along the coast, and contour lines for the sea floor came later (check).

Dangers

Rocks, wrecks, shoals and tidal races are marked, along with safe channels and anchorages.

Aids

Lighthouses, buoys, landmarks and compass information help a navigator to fix a position and steer.

The Longitude Problem

Item (check each)	Detail
Latitude	Found from the height of the sun or the Pole Star above the horizon, using an instrument such as a quadrant or sextant.
Longitude	Needs the difference between local time and the time at a reference place. Without a clock that kept good time at sea, sailors estimated it by dead reckoning, using speed, heading and time.

Item (check each)	Detail
Disaster, 1707	A Royal Navy fleet under Sir Cloudesley Shovell was wrecked on the Isles of Scilly, with great loss of life, an event often linked to the longitude problem (check the causes).
Longitude Act, 1714	Parliament offered large prizes for a practical method (check the amounts and conditions).
Two answers	The lunar-distance method, using the moon's position among the stars, and the marine chronometer (check).
John Harrison	A clockmaker from Yorkshire who built a series of timekeepers, H1 to H4, tested in the 1730s to 1760s. His dealings with the Board of Longitude were long and difficult (check the story).

Not a single invention

The popular story presents Harrison as a lone genius against the establishment. Historians stress that the solution came from several lines of work, astronomical tables for the lunar method, clockmaking, and the practical trials at sea. Chronometers did not come into general use at once, because they were costly, and lunar distances remained in use for decades (check). The honest summary is that longitude was solved by both astronomy and clockmaking, over many years.

Surveying the Seas

- **Hydrography.** The science of measuring and charting the waters.
- **The Admiralty.** The Royal Navy established a hydrographic office in 1795, with Alexander Dalrymple as its first hydrographer, and it became a source of charts for the navy and for merchant ships (check the dates).
- **Captain James Cook** surveyed Newfoundland in the 1760s, and charted large parts of the Pacific on later voyages (check).
- **Francis Beaufort,** Hydrographer from 1829, expanded survey work and is also known for the wind scale (check).
- **Today.** The UK Hydrographic Office, based in Taunton, continues the work, and charts are now mostly electronic (check).

Land map	Sea chart (check)
Shows buildings and roads	Shows depths, rocks and channels
Features stay in place	Sandbanks shift, wrecks appear, so charts need constant corrections
Users can stop and look around	Users depend on the chart in poor visibility
Errors cause inconvenience	Errors can cost lives

A British comparison

The Royal Observatory at Greenwich, founded in 1675 to improve navigation, gave its name to the prime meridian, adopted as the world's reference at a conference in Washington in 1884 (check). A visit shows the meridian line in the courtyard, and some of Harrison's timekeepers are on display at the Royal Museums Greenwich (check what is currently shown).

Check the details

Numbers for prizes, the date and cause of the Scilly disaster, and the sequence of Harrison's clocks vary between popular accounts. Check them against a scholarly source such as the Royal Museums Greenwich.

Exercises

EXERCISE 1

Explain why knowing the time at a reference place gives your longitude, using the idea that the Earth turns 360 degrees in 24 hours.

→ Solution

EXERCISE 2

Write a balanced two-paragraph account of the longitude story that credits both astronomy and clockmaking.

→ Solution

EXERCISE 3

Look at a sea chart for a harbour you know, from an online source or from a boating guide, and list ten symbols you can identify.

→ Solution

Quick Reference

- **Latitude:** sun or star height
- **Longitude:** time difference, 15 degrees per hour
- **Solutions:** lunar distances and chronometers
- **Charts:** depths, dangers, aids; kept up to date
- **Britain:** Admiralty hydrography, Greenwich

History of Maps and Cartography

Course 1 · Chapter 8 · Thematic Maps and Maps as Argument

So far the maps in this course have shown where places are. From the eighteenth century, mapmakers began to use the map frame to show something else, such as disease, trade, population or a rail network, and to make an argument by the pattern. The same tools were used to persuade, to claim land and to draw borders. This chapter looks at the best-known examples and at how to read them with care. Names and dates are from general knowledge and flagged "check".

Maps That Show a Theme

Choropleth

Areas shaded by a value, such as population density by district. The boundaries chosen can change the picture (check).

Dot and symbol maps

Each dot or symbol stands for a count of something, as in a map of cases of an illness.

Flow maps

Lines whose width shows the size of a movement, such as trade or troops.

Famous Examples

Map (check each)	What it did
Halley's chart of winds, 1686	Edmond Halley published a map of trade winds, among the earliest thematic maps of a natural phenomenon.
John Snow's cholera map, 1854	Showed deaths around the Broad Street pump in Soho, London. It supported his argument that cholera was spread by water, though the map was one part of an investigation that included interviews and statistics, and it did not by itself end the epidemic (check).

Map (check each)	What it did
Charles Joseph Minard's map of Napoleon's Russian campaign, 1869	A flow map showing the army's size, location and the temperature on the retreat, famous as an example of rich information drawn simply (check).
Harry Beck's Tube map, 1931	A diagram that straightened the lines and equalised the spacing of stations, accepted by London Underground after some hesitation and revised many times (check).
Booth's poverty maps of London, 1889	Charles Booth coloured streets by the social conditions of their residents, a pioneering social map (check).

The Snow story

The popular account says that Snow removed the handle of the pump and ended the epidemic. The outbreak was already declining, and the authorities' action probably had a limited effect. The map's value was as an argument and an illustration, and the long-term effect was the acceptance that cholera is waterborne (check the details with a scholarly account). This is a good example of why a famous story should be checked against the evidence.

Maps That Persuade

- **Projection as rhetoric.** Maps centred on one country, or showing a threat by spreading a colour across Eurasia, send a message by design (check examples).
- **Propaganda maps.** In the twentieth century, governments used maps to claim territory or to alarm their citizens. Look at what is coloured, what is cropped and what is labelled (check).
- **Empire.** Maps of the British Empire often used red or pink for imperial possessions, which, combined with Mercator's inflated high latitudes, made the empire look larger (check).
- **Colonial borders.** Many borders in Africa and the Middle East were drawn by European powers, partly on maps with little knowledge of local people. The Berlin Conference of 1884–85 is often cited, though borders were set by many agreements over decades (check).
- **Names.** Choosing a name for a place on an official map can be a political act (check).

Technique	Effect (check each)
Choice of colours	Red suggests danger or importance; pale colours suggest weakness
Choice of boundaries	Large districts hide local variation (the modifiable areal unit problem)
Scale and crop	A cropped map can leave out a neighbour that changes the meaning
Data classes	Where class breaks are set decides what looks "high"
Title and legend	The words around a map frame its message

A British comparison

The Tube map is the most copied diagram in British design, with versions for other cities. It also shows the risk of a diagram: the distance between two stations looks small or large regardless of the walking distance, and Transport for London has published a walking-time map for that reason (check). A passenger who believes the diagram's geography will walk the wrong way.

Check the details

Check the story and dates for Snow, Minard and Beck in a reliable history of cartography before repeating them. Be careful with online claims that a map was "banned", "suppressed" or "secret", and ask for the source.

Exercises

EXERCISE 1

Choose one thematic map and write down what it claims, how it shows the claim and what it leaves out.

→ Solution

EXERCISE 2

Rewrite the common account of John Snow and the pump so that it matches the evidence more closely.

→ Solution

EXERCISE 3

Take a set of numbers (such as ten districts' values) and show how changing the class breaks changes the story a shaded map tells.

→ Solution

Quick Reference

- **Thematic maps:** choropleth, dot, flow
- **Examples:** Snow, Minard, Booth, Beck
- **Persuasion:** colour, crop, boundaries, classes, titles
- **Borders:** often drawn by outside powers
- **Habit:** ask who made the map, and why

History of Maps and Cartography

Course 1 · Chapter 9 · Photographs, Satellites and Screens

In a little over a century, mapping moved from men with chains and theodolites to aircraft cameras, satellites and a phone in the pocket that knows where it is. The tools changed more than the questions: someone still chooses what to show, from which data and for whom. This chapter traces the technical steps and then asks who makes today's maps. Names and dates are from general knowledge and flagged "check".

From the Air

Aerial photography

Photographs from balloons and aircraft were used for mapping in the First World War, and after it, overlapping photographs were used to make measured maps by the science of photogrammetry (check).

Stereo pairs

Two overlapping photographs viewed together give a three-dimensional impression, from which heights and contours can be measured (check).

Ground control

Known points on the ground, fixed by the survey network of the previous chapter, tie the photographs to the national grid.

From Space

Step (check each)	Detail
Landsat, from 1972	A US programme of Earth-observing satellites that has provided a long record of images of land cover and change.
Remote sensing	Sensors record light at various wavelengths, which allows maps of vegetation, water and heat, not only of what the eye sees.

Step (check each)	Detail
GPS	A US system of satellites developed for the military and opened to civilian use. A receiver finds its position by timing signals from several satellites, using the same principle of time as the longitude problem (check).
Other systems	GLONASS (Russia), Galileo (the European Union) and BeiDou (China) provide similar services (check).
Radar and laser	Lidar, a laser scanner, can map the ground surface even under tree cover, and has revealed archaeological sites hidden by forests (check examples).

Time and position

A GPS receiver needs an accurate time because it calculates distance from the time a signal takes to arrive. An error of a millionth of a second is a few hundred metres. The satellites carry atomic clocks, and the system must also correct for effects of relativity (check). The old longitude problem is solved by the same principle, with far better clocks.

GIS and Web Maps

- **GIS.** A geographic information system stores data in layers, such as roads, rivers and census areas, which can be combined and analysed. Early work in the 1960s, such as the Canada Geographic Information System, led to the commercial tools of today (check).
- **Web maps.** Services such as Google Maps (launched 2005) and its competitors put zoomable maps into a browser, using the Web Mercator projection (check).
- **OpenStreetMap.** Founded in 2004 in London by Steve Coast, it is an open map built by volunteers, using GPS traces, aerial imagery and local knowledge, and used by many apps (check).
- **Phones.** Navigation apps combine maps, GPS and live traffic data, collected from users' devices.
- **Open data.** Many national mapping agencies, including Ordnance Survey, have released some data free of charge (check which).

Question	Why it still matters (check each)
Who decides what is shown?	A company chooses which places and labels appear at each zoom level.
Whose names?	Disputed territories may be labelled differently for different users.
Who is missing?	Data is thinner where fewer people contribute or where little is recorded.
What is collected about you?	Location history is valuable, and private, data.
What happens when it is wrong?	Drivers have followed routes into hazards and onto unsuitable roads.

A British comparison

Ordnance Survey's open data allows anyone to build maps of Britain, and Edinburgh's volunteers have mapped footpaths, cycle routes and shops on OpenStreetMap. Comparing the same street on Ordnance Survey, OpenStreetMap and a commercial service shows three different decisions about what is worth showing (check the layers available).

Check the details

Check launch dates, technical claims and the status of services before relying on them, since they change quickly. Treat any screen map as a product of choices by a company or community, not as a neutral window.

Exercises

EXERCISE 1

Explain how a GPS receiver finds its position, and why it needs several satellites.

→ Solution

EXERCISE 2

Compare the same neighbourhood on three different digital maps and list the differences in what is shown and named.

→ Solution

EXERCISE 3

Describe two ways in which a digital map could be wrong or misleading, and how a user could detect each.

→ Solution

Quick Reference

- **Air:** aerial photographs, stereo pairs, ground control
- **Space:** Landsat, GPS and other satellite systems
- **Data:** GIS layers, lidar, open data
- **Web:** Web Mercator, OpenStreetMap
- **Questions:** who chooses, whose names, who is missing

History of Maps and Cartography

Course 1 · Chapter 10 · The Map Is Not the Territory

The phrase "the map is not the territory" is usually credited to the philosopher Alfred Korzybski (check). It is the thread of this course: every map, from a clay tablet to a phone screen, is a choice about what to show. This last chapter sets the story on one timeline, tests the myths raised in Chapter 1, and offers a short method for reading any map you meet. Names and dates are from general knowledge and flagged "check".

Timeline

Date (check each)	Event
About 600 BC	Babylonian clay-tablet world map (Chapter 1)
Third century BC	Eratosthenes estimates the Earth's size (Chapter 2)
Second century AD	Ptolemy's *Geography* (Chapter 2)
1154	Al-Idrisi's work for Roger II of Sicily (Chapter 3)
About 1300	Hereford Mappa Mundi and early portolan charts (Chapter 3)
1507	Waldseemüller's map names America (Chapter 4)
1569 and 1570	Mercator's world map; Ortelius's atlas (Chapters 4 and 5)
1747–1755	Military Survey of Scotland (Chapter 6)
1791	Ordnance Survey founded (Chapter 6)
1714 and 1760s	Longitude Act; Harrison's timekeeper trials (Chapter 7)
1854	Snow's cholera map (Chapter 8)
1931	Beck's Tube map (Chapter 8)
1972 onwards	Landsat, then GPS and web maps (Chapter 9)

Myths Revisited

Myth	What the evidence suggests (check each)
Medieval people thought the Earth was flat.	Educated writers described a sphere; mappae mundi are diagrams of the known world (Chapter 3).

Myth	What the evidence suggests (check each)
Columbus proved the Earth was round.	The dispute was about its size, and Columbus underestimated it (Chapter 4).
The Mercator map is "wrong".	It does what it was designed for, and misleads when used for comparing areas (Chapter 5).
Sea monsters show that people believed in them.	They also served as decoration, warning and symbols of the unknown (Chapters 3 and 4).
John Snow's map ended cholera.	It was an argument within a wider inquiry, and the epidemic was already declining (Chapter 8).
Harrison alone solved longitude.	Astronomy and clockmaking both contributed (Chapter 7).
Digital maps are neutral.	They embody choices about data, names and design (Chapter 9).

Six Questions for Any Map

1. Who made it?

A person, a state, a company or a community, and with what training and interests.

2. For whom and why?

A traveller, a ruler, a student, a customer. The purpose decides what is included.

3. From what source?

A survey, an older map, a report or a data feed. Copied errors travel far.

4. What choices does it make?

Scale, projection, orientation, symbols, colours, class breaks and labels.

5. What does it leave out?

People, places, uncertainties and alternatives that would change the message.

6. How would I check it?

Compare with another map, a survey, the ground or a reliable account.

A Worked Example

The claim

A news article shows a world map with a large red shape across Africa and the caption "the continent is bigger than the whole of Europe, the United States and China combined". Is the map a fair picture?

- **Who and why?** A graphic made to make a point about size, probably to correct the impression given by Mercator maps (check the source).
- **Choices.** The map has to move countries onto Africa's outline, so it uses an equal-area view or a drawn comparison, and the countries must keep their true areas.
- **Check.** Africa's area is about 30 million square kilometres, which can be compared with figures for the other countries, with an allowance for how land area is counted and which territories are included (check the numbers).
- **What it leaves out.** Gaps between countries when they are packed in, and the fact that area says nothing about population or wealth.
- **Verdict.** The point is probably sound as a statement of area, and the exact claim depends on figures that should be verified.

A British comparison

Next time you use an Ordnance Survey Explorer map for a walk, ask the same six questions. The sheet is the product of a long survey, and its symbols, contour interval and footpath information are decisions. The walk itself, with its mud, weather and stiles, is the territory, which the map can only represent.

Check the details

The attribution of "the map is not the territory" to Korzybski, and every date in the timeline, should be checked in a reliable source before you quote them.

Exercises

EXERCISE 1

Apply the six questions to a map of your choice, and write a short assessment of how far to trust it.

→ Solution

EXERCISE 2

Choose one myth from the table and write a one-paragraph correction with the evidence it rests on.

→ Solution

EXERCISE 3

Make your own map of a place you know well, such as your route to work, for a particular purpose, and write down five choices you made.

→ Solution

Quick Reference

- **Thread:** the map is not the territory
- **Six questions:** who, why, source, choices, omissions, checks
- **Method:** state what is documented, claimed or unknown
- **Projection:** fit it to the task
- **Digital maps:** still made by people, with choices

Course complete

You have finished *History of Maps and Cartography*: what a map is, the Greek geographers, the Roman and medieval traditions, print and the age of discovery, projections, national surveys, charts and longitude, thematic maps, satellites and screens, and a method for reading any map. Related courses on the site include *The Age of Exploration*.