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Cartography and the Study of Maps

Think Over

If there was no map of our world, how different would your life be?

Dulichand and Sushila live close to each other. One day, they got into an argument over the positioning of water drain. They called the patwari to settle the dispute. How do you think the patwari resolved the issue?

Direction, scale and symbols are important in any map. So we will begin by first learning about what these terms mean.

Direction: If someone asks you in which direction the east lies, you will probably point in the direction where the sun rises. If you know one direction, it is easy to figure out the other three main directions. We all know that there are four main (cardinal) directions – north, south, east and west.

If we stand facing the sun when it rises, the direction in front of us is ……., behind us is……., to our left is……, and to our right is ……..

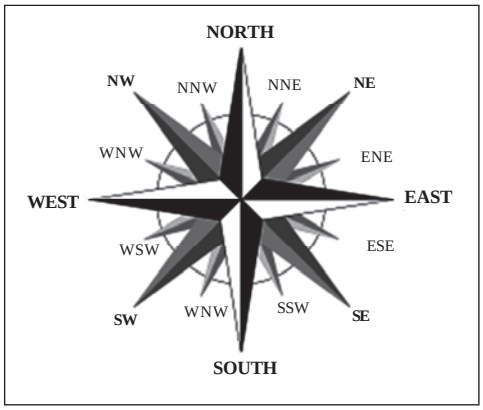


Figure 1.1: Directions

The directions between the four cardinal directions are called ……., ……., ……. and ……. respectively.

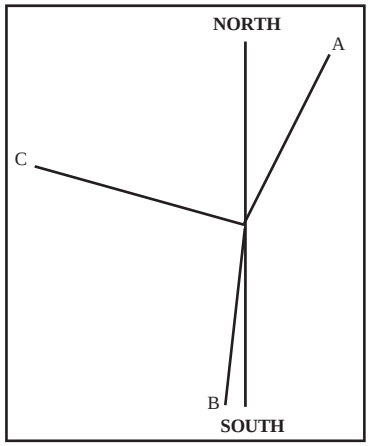


Figure 1.2: Measuring direction

In Figure 1.1, the direction between north and north-east is ……., between south and south-east is ……., between south and south-west is ……., between north and north-west is …….

Any direction can be explained by using the correct angle. A compass has 360 degrees. To know the correct direction to a place, we assume the north is zero and then calculate the angle of that place. All angles are measured in a clockwise direction beginning from the north.

In Figure 1.2, the places A, B and C are at 29°, 186°and 284° respectively from the point of reference (north).

When a pilot lands an airplane on the runway, he aligns the airplane with the centre of the landing strip with the help of the angle shown in the landing instrument (compass).

Figure 1.3: The landing strip (runway)

Find out from your elders:

What are the different names they use for the different directions?

When do they use these directions in their daily lives?

How do you find the direction to a new place? We use the sunrise and sunset, the Pole Star or a magnetic needle to help us find the direction. The Pole Star tells us the direction of the geographic north, because it is always at a right angle to the 90° northern latitude (North Pole). The geographic north is also called the true north. It is used to draw maps. Opposite to the geographic north is the geographic south (South Pole).

There is another north apart from the geographic north. It is called the magnetic north. Magnetic needles always point to the magnetic north. The earth is a powerful magnet. Its core is made mostly of nickel and iron. However, this is a little away from the geographic north. The magnetic North and South Poles keep shifting, whereas the true North and South Poles remain fixed.

Magnetic North Pole	**(2004) 82.3°N 113.4°W**	**(2007) 83.9°N 120.7°W**
Magnetic South Pole	**(2004) 63.5°S 138.0°E**	**(2007) 64.4°S 137.6°E**

Direction in Maps

If you stand facing a map, the north is at the top, the south is at the bottom, the east is to your right and the west is to your left. These directions are actually relative. Relative means seeing one thing in the context of another. For example, in which direction from Raipur does Jagdalpur lie?

Reading a map after placing it in the true direction is called 'orientation'. Place the map of India on the floor, orient it, and answer the following questions:

1. **In which direction from Rajasthan does Himachal Pradesh lie?**
2. **In which direction from Chhattisgarh does Gujarat lie?**
3. **In which direction from Chhattisgarh does Nepal lie?**
4. **In which direction from Uttarakhand does Nepal lie?**
5. **In which direction from Arunachal Pradesh does Nepal lie?**
6. **In which direction from Gujarat does Pakistan lie?**
7. **In which direction from Jammu & Kashmir does China lie?**
8. **In which direction from Andaman & Nicobar Islands does Sri Lanka lie?**
9. **In which direction from Kanyakumari does Sri Lanka lie?**
10. **In which direction from Manipur does Bangladesh lie?**

Map 1.1: India

Scale: A map shows a portion of the earth in a very small size on paper. We use scale to ensure that the actual distance between two places is proportionately maintained in the map. So a scale is the relationship or ratio of the distance between two places in a map to the actual distance between the two places on the earth's surface. We assume this ratio in a map. In India, we use the metric system so the basic unit of the scale is one centimetre. The corresponding distance of this unit on the earth's surface is also written in the metric system.

Two maps can have different scales, but the same map can't have two scales. If you draw a map of your school, you can decide how many metres on the ground 1 cm represents on the map. If you have to draw the map of a city on a sheet of paper of the same size, then the scale may become 1 cm = 1 km.

Scale is stated in three ways on maps.

1. Word statement
2. Linear scale
3. Representative fraction

1. Word statement: The scale is written in words. For example, 1 cm = 10 km. In this scale, a distance of 1 cm on the map equals a distance of 10 km on the ground.

2. Linear scale: This is a straight line scale marked in centimetres, with the corresponding actual distances on the ground also marked on the scale. If you want to use this scale to find the actual distance between two places shown in the map, you first measure the distance with a ruler, then place your ruler on the straight line scale to find out the actual distance. However, calculating the exact distance may not be easy because the ratio in this scale is not simple. You may have to go into decimal places to calculate the exact distance. For instance, if 8 cm in the scale equals 10km, you will have to calculate how many km one cm represents to get a simple ratio.

3. Representative fraction: This scale is widely used in atlases and maps these days. It is a simple scale. If a map shows a scale written as 1:100,000, it means that a distance of 1 cm between two points on the map represents an actual distance of 1,00,000 cm on the ground. 1,00,000 cm equals 1 km. So a distance of 1 cm on the map stands for the actual distance of 1 km on the ground. In this scale, distances on the map and actual distances on the ground are written using the same unit. So the distance between two points on the map and the actual distance between the two points on ground is the ratio of the scale. If two places are situated at a distance of 20 km and the distance shown in the map is 2 cm, the scale of this map would be 2/20 = 1/10 or 1 cm = 10 km. That means 1 cm on the map equals a distance of 10 km on the ground.

If two places are 50 km apart, what will be the distance between them in a map drawn to the scale 1 cm = 10 km?

Convert the representative fractions given below into word statements:

1:50,000 (1 cm represents ……. km)

1:10,000 (1 cm represents ……. km)

1:1,34,000 (1 cm represents ……. km)

1:1,500,000 (1 cm represents ……. km)

1:5,00,00,000 (1 cm represents ……. km)

1:2,56,70,000 (1 cm represents ……. km)

Symbol: We cannot show the actual size or shape of features such as houses, roads, railway tracks, trees, etc in a map. That's why we use images, colours, alphabets, lines, shadows, shades, etc to depict them. Using these symbols enables us to pack a lot of information about a place. They also make it easier to study these features. We use different symbols in different kinds of maps.

How were maps made in the days when there was no printing press?

The person who draws a map (cartographer) uses standard symbols and scales to depict various features in the map. This ensures that everyone who reads the map understands exactly what the cartographer wants to show. So standardization of symbols ensures uniformity in interpreting the map, especially when maps are printed in such large numbers. Many of these symbols have been conventionally used and are easily recognized by people. Examples would include symbols of natural and man-made landmarks. The constant attempt is to simplify the symbols used so that the common people can easily recognize and understand them.

Conventional symbols: We know that maps show different parts of the world and their features on a small sheet of paper. So everything is reduced in size and shown in two dimensions (flat). There isn't enough space on this flat surface to show all the physical details of that part of the world. That's why, as we said earlier, some basic symbols are used to represent those details. These symbols give a lot of information about the physical features of an area in a small space.

There is an international agreement that all countries in the world will use the same symbols when drawing maps. The advantage of having a standard symbol that is used worldwide is that a person can study a map with the help of these symbols even if he or she doesn't know the language of the particular country. Some of these standard international symbols are shown in Figure 1.4.

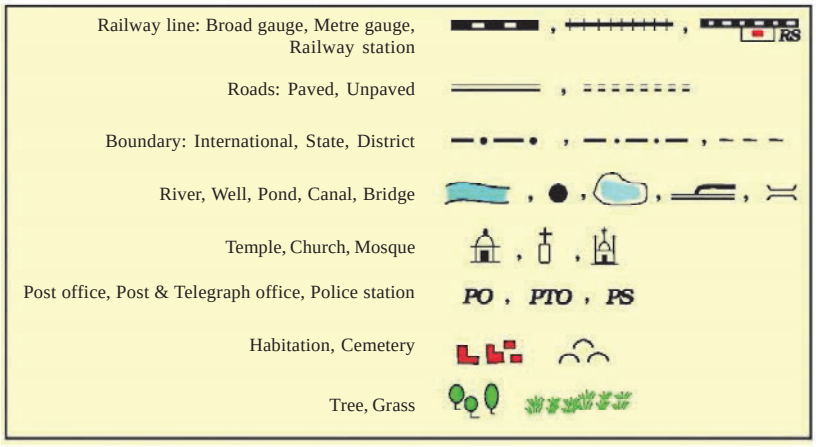


Figure 1.4: Some standard international symbols used in maps

Project Work

Draw a map of everything you see in your village or neighbourhood, using the symbols given in Figure 1.4

Your school is building a laboratory for Class 9. This requires the construction on a new room in the school campus. First, make a map of the school campus as you see it. Use this rough map to prepare a scale map of the campus.

Types of Maps

There are many different kinds of maps, such as physical maps, political maps and thematic maps. Maps that show the natural features of the earth (mountains, plateaus, plains, rivers, oceans, etc) are called physical maps. They give information about the physical features of that region of the earth. Maps that show countries, provinces, cities, villages and the boundaries between different countries and provinces are called political maps. Maps that give information about a specific topic - such as transportation, temperature, rainfall, forest, industry, population, etc - are called thematic maps.

Study the physical and political maps of India. In which map are the following features found?

Put a tick (✓) mark in the correct column:

S No	Description	Political map	Physical map
1.	Colours of seas and oceans		
2.	Colours of states		
3.	Boundaries of states		
4.	Boundaries of countries		
5.	Index of symbols (key)		
6.	Scale		
7.	Information about rivers		
8.	Mountains, plateaus and plains		

Relief (Topographic) Maps

Relief generally means the difference in elevation (high or low) between different parts of the earth's surface, which include mountains, plateaus, plains, rivers, valleys, etc. Maps are drawn on sheets of paper. How do we show these differences in elevation on a flat sheet? There are three ways of showing relief in a map: the spot height method, the contour line method and the colour shading method.

In Class VII, you learnt that all places situated at same height from the sea level (the same elevation) are connected with a single line in a map. This is called a contour line. The elevation of any place on the earth's surface is measured from the sea level. Contour lines are generally drawn at fixed distances - 20 metres, 50 metres, or 100 metres. Earlier, land surveys were conducted to measure surface elevations and draw contour lines. But with the invention of photography, land surveys are done by aerial photography and used in drawing relief or topographic maps.

Characteristics of Contour Lines

* Contour lines join places situated at the same height from sea level.
* Contour lines and their shapes depict the slope and height of landforms.

* Contour lines drawn close together show steep slopes. Contour lines that are more spaced show gentler slopes.
* Two contour lines of different heights don't cross each other. (Discuss why they do not cross.)

Study the physical map of Chhattisgarh (reference map 12) and find the approximate height of the following places:

1. **Jashpur and Dantewada**
2. **Raipur**
3. **Your district headquarters**
4. **The source of the Mahanadi**

Study reference maps 11, 14, 15, 16 and 17 (Chhattisgarh) before answering the following questions. Which map is your answer based on?

1. **In which direction does Narayanpur lie from Raipur?**
2. **What is the distance between Korba and Kanker?**
3. **In which direction does Gariaband lie from Kabirdham?**
4. **What is the actual distance between Durg and Raigarh?**
5. **Which districts have dense forests?**
6. **Which districts have high average temperatures in summer and winter, and what are their annual average temperatures?**
7. **On the basis of the maps can you tell why Bijapur has more forest cover compared to Durg district.**

The Story of Mapmaking

Why do you think people needed maps in the past? What were these maps like?

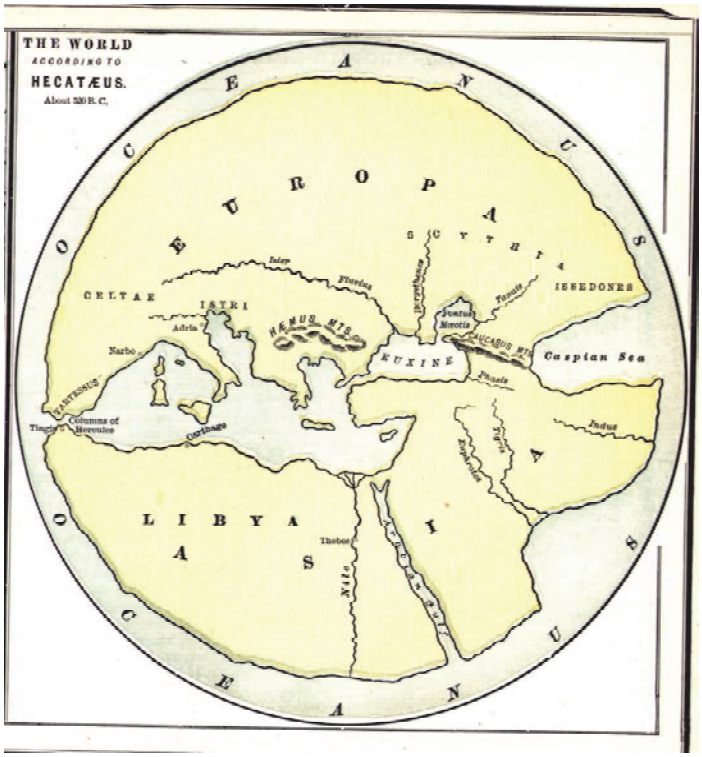
It took more than 3,000 years to develop the maps that we use today. Human beings have been drawing maps since ancient times. But these ancient maps were quite unlike today's maps. They were mostly line diagrams and were not drawn to scale. They pictorially depicted the earth's physical features. The maps of the modern era are more scientifically developed.

Historically human knowledge of the earth grew with travel and observation and map making too went hand in hand with this. The first maps were made by the Egyptians more than three thousand years ago. They showed the fields bordering the banks of the Nile River. So we can surmise that maps were first used to register land ownership. Nowadays, patwaris have maps that show the agricultural fields of their village. These maps show who owns which piece of land.

Figure 1.5: A map from Babylon engraved on a clay tablet

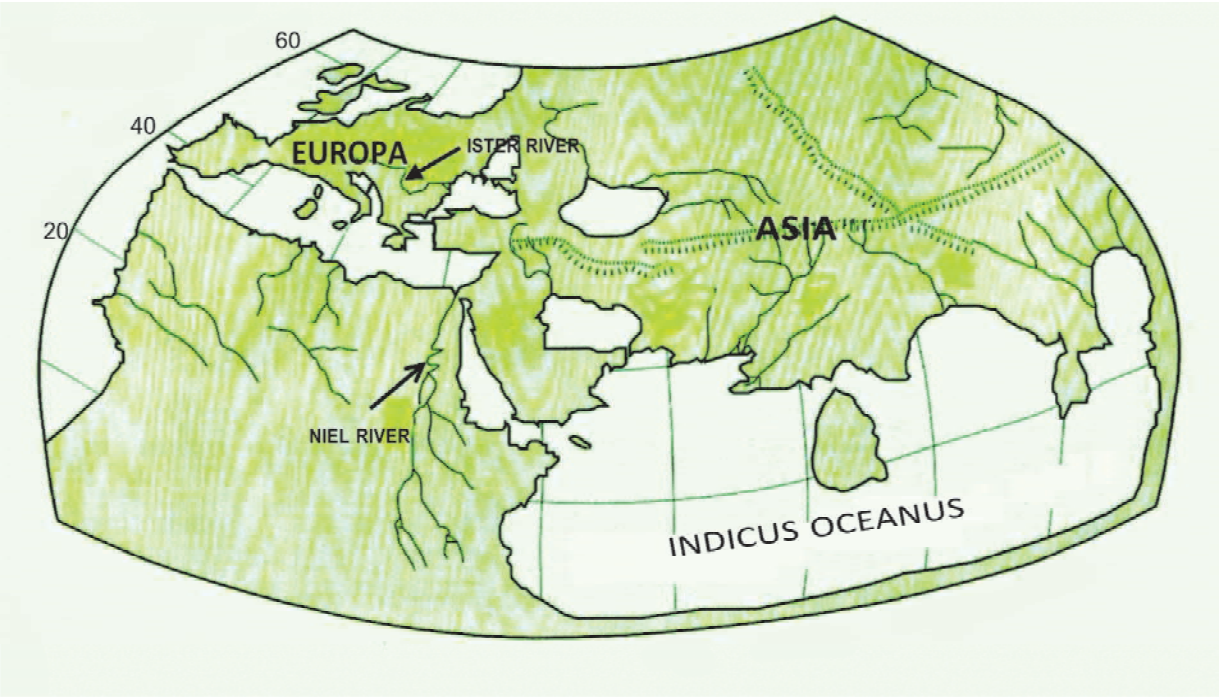
The oldest map of the world is a clay tablet from Babylon (present-day Iraq). Made around 600 BCE, it shows the city of Babylon, the Tigris and Euphrates rivers, mountains, islands and the surrounding seas. This was the world the people of that age knew. This map is currently kept in the British Museum.

How did the art of drawing maps develop? The geographers of ancient Greece were the first to develop the art of map drawing as we know it today. Hecataeus prepared a map of the world sometime during the 5th or 6th century BCE. He lived near the Mediterranean Sea. In those days, people did not believe the earth was round. They believed it was shaped like a saucer, with Greece at its centre. That world was divided into two continents – Europe and Asia.



Map 1.2: The world of Hecataeus

The Roman Empire rose to power following the decline of the Greek states. Its territory extended from Central Europe, France, Italy and Britain to Turkey. The most well-known geographer of the time was Ptolemy. He was the first to understand the importance of latitude and longitude in map making. Based on this concept, he drew a map of Europe and the world. The eastern boundary of the map was China and the western boundary was Spain and its neighbouring countries.



Map 1.3: Ptolemy's world map

Map 1.4: Marco Polo's journey

After the downfall of the Roman Empire in the 2nd century CE, Europe went through a period when scientific thinking was suppressed, which continued until the 7th century CE. The art of cartography also stagnated during this period.

The famous Arab cartographer Muhammad al-Idrisi, who made maps for his king, rose to prominence in the 11th century CE. One unusual feature of the maps of this royal cartographer was that he showed the southern direction towards the top and the northern direction towards the bottom. Also, Arabia was placed at the centre of his world.

Cartography developed rapidly after the 13th century CE when European navigators required reliable information for their ocean voyages of exploration. Marco Polo, Columbus, Vasco da Gama, Magellan and Captain Cook undertook their long voyages that expanded the existing knowledge about the continents and the oceans. The first globe was created during this time. The printing press was also invented in Europe in the 15th century CE, making it possible to print maps. So it was the navigators who widened the scope of map-making and improved the standing of the art of cartography.

Marco Polo (1254–1324 CE) set out on his journey from the city of Venice in Europe. Following a land route, he reached China, travelling through Turkey and Jerusalem. Taking a sea route from East China, he reached Vietnam, the Malay Peninsula, Sumatra, the Nicobar Islands, Sri Lanka and the western coast of the Indian subcontinent.

Vasco da Gama (1460–1524 CE)

When Columbus was busy exploring the New World, the Portuguese were also trying to find an eastern sea route to India. Starting his journey in 1497 CE, Vasco da Gama reached the island of Cape Verde. He proceeded to navigate the then unknown southern Atlantic Ocean, arriving at the south-western coast of Africa. This was the longest sea journey ever undertaken until then. His crew began to fall ill and wanted to return to Portugal. But Vasco da Gama was unswerving in his aim to reach India. Crossing the southern tip of Africa at the Cape of Good Hope, he continued northwards to reach the Zambezi River. His crew were afflicted with scurvy. The sailors' hands and feet were swollen and their teeth began to drop.

Despite these travails, Vasco da Gama kept sailing. He came across Arab traders near Mozambique who encouraged him to sail towards India. He finally succeeded, reaching Calicut on India's western coast on May 20, 1498. This discovery of a sea route from Europe to Asia opened up the possibility of European trade with the East, especially India. **The long voyages of exploration by European navigators transformed map making from an art into a science.**

A new era in cartography began in the 15th century CE. Its foundation was laid by the re-discovery of

Ptolemy's book the *Geographia*, which was translated into several languages. The book popularised maps and their significance. The enthusiasm it generated led to the opening of many new schools of cartography in Italy, France, Britain and Germany. The Arabs had blocked the land route via the Mediterranean Sea to India. **So merchants of Western Europe started looking for alternative paths to continue doing business with India.**

Map 1.5: The journey of Vasco da Gama

Holland became a prominent trading hub during the 16th century CE, establishing its domination over the seas. Its mercantile success spurred the development of cartography. Among the famous Dutch cartographers of the time, the most well-known was Father Gerardus Mercator (1512–94 CE). He spent most of his time in map making, reviewing previous work in the field. He is known today for his Mercator projection. This is the projection technique we use today to make maps of the world.

Cartographers placed their own countries at the centre of their world maps. Why?

Al-Idrisi located the south at the top of his maps while the Greeks located the north at the top. Why this difference?

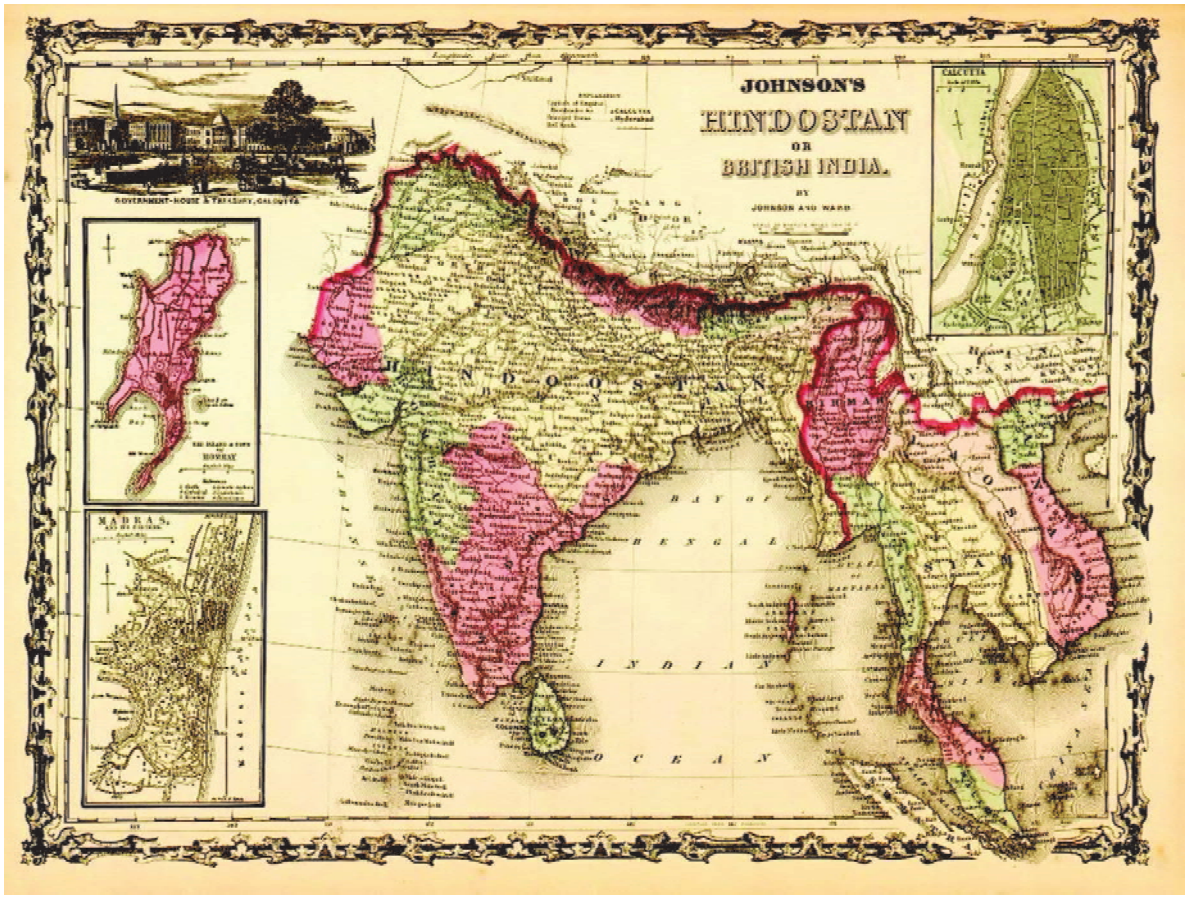
Colonisation, Discovery, Military Use and Map-making

European navigators discovered new continents and countries. They also discovered new sea routes to reach there. They found that America, Africa, Australia and Asia were rich in resources. The European kings were eager to learn more about the resources, climate and inhabitants of these places. They sent their scientists and cartographers to different parts of the world to create new maps. These people crossed continents, mountains, deserts and rivers to collect information about the interior regions of these new lands to include in their maps.

Thus, knowledge about the resources of these new regions reached the European rulers through maps. Their desire to exploit these resources led to the rise of colonialism. In the process, the European rulers established new colonies.

When the British began establishing their power in India, they started preparing maps of the interior regions of the sub-continent. They surveyed the whole country and set up the Survey of India department to oversee the map making work. James Rennell was appointed the Surveyor General. He prepared the first map based on the findings of the survey.

Map 1.6 is the map of India created during the British period. Compare it with the current map of India.



Map 1.6: A map of British India

William Lambton initiated the most comprehensive survey in the world in 1802 CE. The survey covered elevations and distances from Madras (Chennai) in the south to the Himalayas in the north. Sir George Everest completed the survey process. The highest point in the world was discovered during the survey. It was named Mount Everest. Scientific methods were used for the first time in this survey, the elevations of all places being measured from the sea level in Chennai where the survey began.

Maps are required the most during wars. They were used extensively during both the World Wars. Many governments hid the maps of their countries to prevent the enemy from taking advantage of them. In the modern age, highly detailed maps are prepared with the help of orbiting satellites and their sophisticated Global Positioning System and Geographic Information System. These maps are used for developmental planning. But governments are finding it more and more difficult to keep their maps as secrets.

Is it a good thing to utilise maps for such public purposes?

Why did colonial powers like Britain focus so much on preparing comprehensive maps?

Application of Maps

We saw how maps were prepared and used for a variety of purposes such as commerce, navigation, conquests, wars, etc. They are also used in developmental planning in our country. Maps help planners to identify the problems a region may be facing. They also help in the search for resources. For

example, some places do not have potable water. Maps can show where water resources - monsoon, groundwater and rivers – are available. A suitable system can then be worked out to make water available to such deficient areas. Sharing the water of rivers, reservoirs and aquifers in this way can ensure that everyone gets potable water.

Maps can also help us design and implement agricultural development schemes. They can help us build new industries, roads, hospitals and schools. Companies can use maps to expand their operations. For example, a mobile network operator that wants to increase its coverage can build microwave towers with the help of maps that show where the villages, towns, mountains and forests are located.

Give suggestions on how maps can be used to design a plan to build new schools, colleges and hospitals.

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Education (शिक्षा)

यदि सड़क उपयोगकर्ता को यातायात नियमों की जानकारी है तो विषम परिस्थितियों में भी सुगमता पूर्वक आवागमन कर सकता है। अतः स्कूल कालेज स्तर पर यातायात शिक्षा अनिवार्य है। वर्तमान में प्रचार-प्रसार, बैनर, पोस्टर आदि के माध्यम से कुछ मात्रा में यातायात की जानकारी दिया जाता है। इस हेतु कई विभाग की आपसी समन्वय की आवश्यकता है।

(1) शिक्षा विभाग
(2) यातायात (पुलिस विभाग)
(3) स्वास्थ्य विभाग



Enforcement (कार्यवाही)

यदि कोई वाहन चालक सड़क पर यातायात नियमों का उल्लंघन करता है तो उस पर सख्ती से वैधानिक कार्यवाही किया जावे, जिससे दूसरे वाहन चालकों को हानि या असुविधा न हो व यातायात सुगम व सुरक्षित हो सकता है। यह परिवहन विभाग व पुलिस विभाग की जिम्मेदारी है।

वाहन चालक को

वाहन चालकों को वाहन चालन के दौरान रखे जाने वाले कागजात :

दोपहिया वाहन चालक
(1) पंजीयन प्रमाण-पत्र
(2) ड्राइविंग लाईसेंस
(3) वाहन बीमा प्रमाण-पत्र
(4) प्रदूषण प्रमाण-पत्र

चार पहिया वाहन चालक
(1) पंजीयन प्रमाण-पत्र
(2) ड्राइविंग लाईसेंस
(3) वाहन बीमा प्रमाण-पत्र
(4) प्रदूषण प्रमाण-पत्र
(5) परमीट सर्टीफिकेट