The Spatial Perspective

Geography is the "WHY of WHERE."

—National Geographic Society

Essential Question: How does the way geographers look at the world differ from that of other scientists?

Geography shares content with many other sciences. Geographers are interested in the phenomena studied by climatologists, botanists, economists, sociologists, and demographers, for example. These scientists study the weather, plants, business, human society, and the characteristics of populations. In this sense, geography is a science of synthesis, a field that integrates the learning of many others. What distinguishes geography from all other fields is that it focuses on a particular perspective, or way of looking at things. That distinctive perspective is spatial.

A **spatial approach** considers the arrangement of the phenomena being studied across the surface of the earth. Important considerations of this approach are things such as location, distance, direction, orientation, pattern, and interconnection. A spatial approach also looks at elements such as the movements of people and things, changes in places over time, and even human perceptions of space and place. Geographers ask questions about spatial distributions such as these:

- Why are things where they are?
- How did things become distributed as they are?
- What is changing the pattern of distribution?
- What are the implications of the spatial distribution for people?

Geography as a Field of Study

Geography has been called the "mother of all sciences." This is partly because it is one of the oldest fields of study. In addition, it is because geographers are interested in the content of so many other sciences. The word *geography* comes from Greek and combines the idea of studying, or writing about (*-graphy*), with the idea of the earth (*geo-*). So the word *geography* means "earth writing."

Subfields of Geography

Geography is commonly divided into two major branches:

- **Physical geography** is the study of spatial characteristics of various elements of the physical environment. Physical geographers, like physical scientists, study topics such as weather and climate, ecosystems and biomes, and volcanism and erosion.
- **Human geography** is the study of the spatial characteristics of humans and human activities.

Human geographers share a spatial approach with physical geographers and often rely on information from physical geography and other physical sciences. The concern of human geographers, however, is the human population and the spatial characteristics associated with people. Human geographers specialize in subfields. These subfields include geographers who study the following:

- population (health, births, migrations, etc.)
- culture (language, religion, popular music, etc.)
- economics (agriculture, level of development, wealth distribution, etc.)
- urban areas (cities, suburbs, challenges from growth, etc.)
- politics (local government, nations, distribution of power, etc.)

The degree of specialization in human geography reflects the wide interests of geographers: there is medical geography, environmental geography, social geography, and even the geography of sports. However, all subfields share a spatial perspective and their interest in human populations.

Since geography studies spatial information, maps are one of the most important tools for geographers. Cartography, the art and science of mapmaking, is closely associated with geography. Many geographers are also cartographers and vice versa. Geospatial technologies, such as satellite imagery and remotely sensed data, geographic information systems (GIS), and global positioning systems (GPS) can require technical skill on the part of their scientists. Geographers rely on cartographers to help them organize spatial information.

The Early History of Geography

For as long as humans have been able to write, they have written "geographies" in their descriptions of place and observations of phenomena on earth. The first maps were probably simply scratched in the soil with sticks by early humans. In the river valleys of the Huang He in China, the Tigris-Euphrates valley in Mesopotamia (modern-day Iraq), and Egypt, ancient people studied geography and made maps.

The Greeks and Romans were the first people in western Eurasia to formalize a study of geography:

- Homer's *Iliad* and *Odyssey* are geographic in nature and point to Greek interest in descriptions of the world.

- Aristotle was a keen observer of the earth and its features and how they influence human behavior.
- Using geometry, Eratosthenes calculated the circumference of Earth from Alexandria in Egypt during the 3rd century B.C.E., and he was very nearly correct. He coined the term *geography*.
- Ptolemy, a Greek who lived about 500 years after Eratosthenes, wrote a summary of Greek knowledge about geography, including the location and size of continents, that dominated European thought for 1,000 years.
- Strabo wrote descriptions of various areas of the Roman Empire and proposed theories about how geography influenced history.

A map based on Ptolemy's view of the world

During the European Middle Ages (about 500 C.E. to 1450 C.E.), Europeans rarely ventured outside their region. But the Muslim culture that flourished in the Middle East and North Africa built strong trading ties with Africa and East Asia. As people traveled, they collected information about new places, created maps, and wrote books about geography. Scholars such as Muhammad al-Idrisi (12th century) and Ibn Battuta (14th century) advanced the study of geography.

The Modern History of Geography

Starting with the historic voyage of Christopher Columbus in 1492, Europeans launched a new era in exploration, description, and mapping. One important geographer of the early modern period was a Dutch scholar, Gerardus Mercator. He created a world map that was very useful for sailors and is still widely used today. In the late 18th century, a German, Alexander von Humboldt, traveled extensively through South America. His study of the continent's wealth in plants and his detailed, accurate maps combined to spur European interest in the Americas. But most importantly, Humboldt saw the world as a connected whole, in which all types of knowledge contributed to each other. It is this approach that has inspired geographers ever since.

In the early 19th century, European geographers established geographical societies, marking the birth of the formal academic discipline of geography. Early efforts remained focused on the great themes of the discipline that had emerged up to that point: exploring, mapping, gathering data about physical and human geography, and seeking to analyze and understand the diversity of the world's regions.

In the past century, geographers such as Carl Sauer (1889–1975) expanded the focus of geography beyond physical traits of the earth to include human activity. Since then, geography has become increasingly diverse and specialized. Geographers study the spatial distribution of nearly everything to explain what people eat to why they migrate to how they vote.

Concepts Underlying the Geographic Perspective

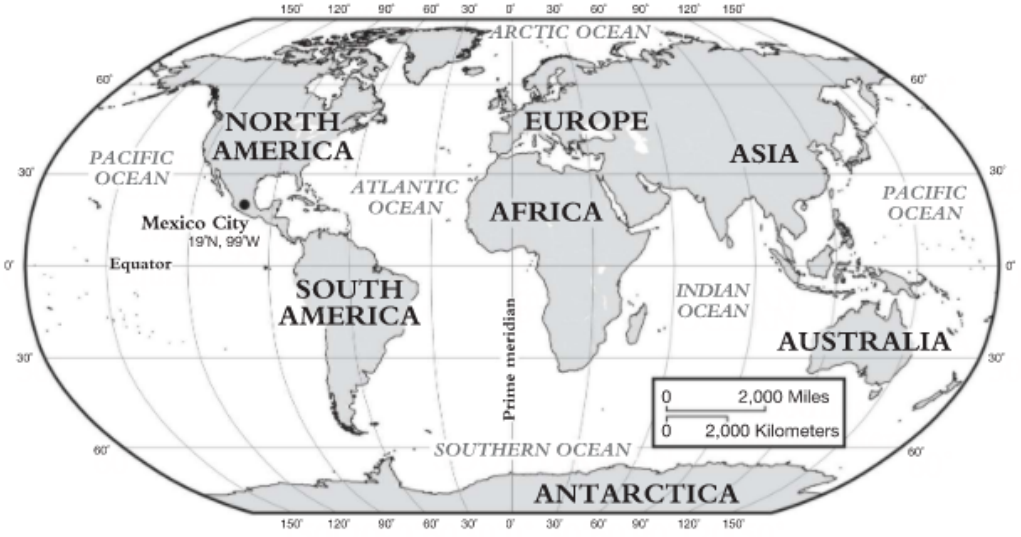
Historians look through the lens of time to understand the past. Similarly, geographers look through the lens of space to understand place.

Location

Locations may be absolute or relative. **Absolute location** is the precise spot where something is according to some system. The most widely used system is the global grid of lines known as latitude and longitude. **Latitude** is the distance north or south of the **equator**, an imaginary line that circles the globe exactly halfway between the North and South Poles. The equator is designated as 0˚ and the poles as 90˚ north and 90˚ south.

Longitude is the distance east or west of the **prime meridian**, an imaginary line that runs from pole to pole through Greenwich, England. It is designated as 0˚. On the opposite side of the globe from the prime meridian is 180˚ longitude. The **International Date Line** roughly follows this line but makes deviations to accommodate international boundaries. Thus, on this system, the absolute location of Mexico City is 19˚ north latitude and 99˚ west longitude.

THE GLOBAL GRID



Relative location is a description of where something is in relation to other things. To describe Salt Lake City, Utah, as being "just south of the Great Salt Lake and just west of the Rocky Mountains, on Interstate 15 about halfway between Las Vegas, Nevada, and Butte, Montana," is one way (of many) to describe its relative location. Relative location is often described in terms of **connectivity**, how well two locations are tied together by roads or other links, and **accessibility**, how quickly and easily people in one location can interact with people in another location.

THE RELATIVE LOCATION OF SALT LAKE CITY

Relative locations can change over time and as accessibility changes. For example, the many **ghost towns** (abandoned settlements) of the western United States once had relative locations near water sources (which dried up), along trade routes (which changed), or near mines (which closed). Their good relative locations lost the advantages—access to resources or trade—that they once had. However, their absolute locations, as described by the global grid of latitude and longitude, remain the same.

Place

Place refers to the specific human and physical characteristics of a location. A group of places in the same area that share a characteristic form a **region**.

Two ways to refer to place are its site and situation. **Site** can be described as the characteristics at the immediate location—for example, the soil type, climate, labor force, and human structures. In contrast, **situation** refers to the location of a place relative to its surroundings and other places.

The situation of Riyadh, Saudi Arabia, is roughly in the center of the Arabian Peninsula; the situation of the Arabian Peninsula is between the

continents of Africa and Asia. When the interstate highway system was created in the United States in the 1950s, the situation of many small towns changed dramatically. Towns along old railroad lines became less important as centers of trade while towns along the new interstate suddenly became more important.

Related to the concept of place is a **sense of place**. Humans tend to perceive the characteristics of places in different ways based on their personal beliefs. For example, the characteristics of Rome, Italy, might be described differently by a local resident than by an outsider or by a Catholic than by a Hindu. If a place inspires no strong emotional ties in people, it has placelessness.

Finally, locations can also be designated using **toponyms**, or place names. Some toponyms provide insights into the physical geography, the history, or the culture of the location. The entire coast of Florida is dotted with communities with "beach" in the name—Fernandina Beach, Miami Beach, Pensacola Beach—all of which are on beaches. Salt Lake City is named for a lake with unusually salty water. Iowa is named for a Native American tribe. Pikes Peak is named for an explorer, Zebulon Pike. Sometimes toponyms get confusing. Greenland is icier than Iceland; Iceland is greener than Greenland. And some toponyms are deceiving. Lake City, Iowa, is not on a lake, and few people consider Mount Prospect, Illinois, at an elevation of 665 feet above sea level, on a mountain.

The Importance of Distance

A consideration of **distance** is an important part of the geographic perspective and spatial approach. Distance is a measurement of how far or how near things are to one another. The term **proximity** indicates the degree of nearness. Distance can be measured in terms of geography and is given in a type of measurement, such as meters, miles, or kilometers. It may be straight-line distance ("as the crow flies") or travel distance using a route that turns and twists. Milwaukee to Kalamazoo is 130 miles by air but 250 miles by car because the normal route goes around the southern tip of Lake Michigan.

Distance and Time

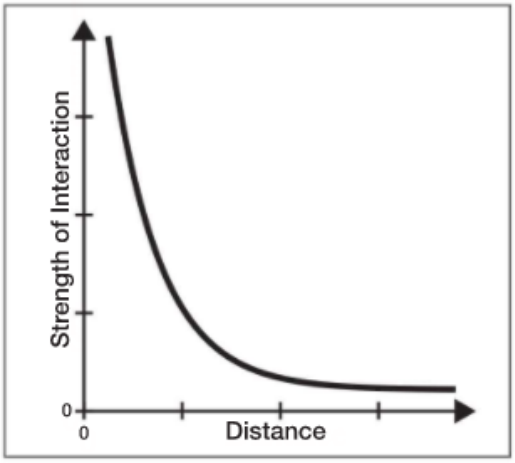
Distance can be measured in terms of time: one place might be "a two-hour drive" from another place. **Time-space compression** is the shrinking "time distance" between locations because of improved methods of transportation and communication. New York City and London are separated by an ocean, but the development of air travel greatly reduced travel time between them. As a result, they feel much closer today than they did in the 19th century.

One result of time-space compression is that global forces are influencing culture everywhere and reducing local diversity more than ever before. In the 19th century, the mountainous regions of southeastern Europe were famous for the local variations in their music. Today, because of radio, the Internet, and other changes, people in southeastern Europe listen to the same music as everyone else in the world.

Distance and Connection

The increasing connection between places is reflected in the growth of **spatial interaction**. Spatial interaction refers to the contact, movement, and flow of things between locations. Connections might be physical, such as through roads. Or they can be through information, such as through radios or Internet service. Places with more connections will have increased spatial interaction.

The **friction of distance** indicates that when things are farther apart, they tend to be less well connected. This inverse relationship between distance and connection is a concept called **distance-decay**. A clear illustration of this concept is the weakening of a radio signal as it travels across space away from a radio tower. Friction of distance causes the decay, or weakening, of the signal. Natural characteristics like waves, earthquakes, and storm systems exhibit the distance-decay function. Human characteristics also exhibit distance-decay, although the key issue is more accurately described as connectedness than distance. When a new pet store opens, its influence is strongest in the area closest to the store but only among the pet owners who have a connection to the store. Improvements in transportation, communication, and infrastructure have reduced the friction of distance between places as they have increased the spatial interaction.



Concepts such as accessibility and remoteness are changing. The world is more spatially connected than ever before in history. The Internet can be used to illustrate several of these concepts. It allows a person living in El Paso, Texas, to shop at a store in New York City (via its website) and receive a product shipped from a warehouse in Atlanta, Georgia. Distance-decay is less influential than it once was.

Density and Distribution

Density is the number of something in a specifically defined area. Population density is the number of people per square mile. Densities are often compared to one another as "higher" or "lower." The population density in a ten-acre city block of tall apartment buildings is likely higher than the population density of a ten-acre block filled with single-family homes. A simple population density for an area can be calculated by counting the people and dividing by the area.

Besides describing density using numbers, density can be described in psychological terms. In a full elevator, one person might feel that the density is fine. Another might feel it is uncomfortably dense.

Geographers are also interested in **distribution**, the way a phenomenon is spread out over an area. Some areas might have a cluster or concentration of something that is sparse in other areas. For example, two city blocks with the same density might have very different distributions. In one, people might be spread evenly throughout the block. The other might consist of a large building where everyone lives and a large park where no one lives. Geographers look for patterns in the distribution of phenomena across space that give clues about causes or effects of the distribution. Common patterns include the following:

- Linear phenomena are arranged in a straight line, such as the distribution of towns along a railroad line.
- Circular phenomena are equally spaced from a central point, forming a circle, such as the distribution of the homes of people who shop at a particular store.
- Geometric phenomena are in a regular arrangement, such as the squares formed by roads in the Midwest.
- Random phenomena appear to have no order to their position, such as the distribution of pet owners in a city.

Matching patterns of distribution is called **spatial association** and indicates that two (or more) phenomena may be related, or associated with one another. For example, the distribution of malaria matches the distribution of the mosquito that carries it. However, just because two distributions have a similar pattern does not mean one is necessarily the cause of the other. The distribution of bicycle shops in a large city might be similar to the distribution of athletic wear stores—but one probably does not cause the other. They both might reflect the distribution of active people.

Human-Environment Interaction

The dual relationship between humans and the natural world are at the heart of human geography. The connection and exchange between them is referred to as **human-environment interaction**. Geographers who focus on how humans influence the physical world often specialize in studying sustainability, pollution, and environmental issues.

The study of how humans adapt to the environment is known as **cultural ecology**. The belief that landforms and climate are the most powerful forces shaping human behavior and societal development is called **environmental determinism**. In the 19th and early 20th centuries, some people used environmental determinism to argue that people in some climates were superior to those of other climates.

In reaction came the view known as **possibilism**, a view that acknowledges limits on the effects of the natural environment and focuses more on the role that human culture plays. Different cultures may respond to the same natural environment in diverse ways, depending on their beliefs, goals, and available technologies.

Landscape Analysis

The word *landscape* comes from older Germanic words that refer to the condition, the "shape," of the land. The term can also imply a specific area, as in a "desert landscape" or the "landscape of Tuscany." The task of defining and describing landscapes is called **landscape analysis**.

Observation and Interpretation

The first part of landscape analysis is careful observation. Geographers are keen observers of phenomena and collect data about what they see. The term **field observation** is used to refer to the act of physically visiting a location, place, or region and recording, firsthand, information there. Geographers can often be found taking notes, sketching maps, counting and measuring things, and interviewing people as they walk through an area that they are interested in studying. For most of the history of geography, this was the only way to gather data about places. All of the information that can be tied to specific locations is called **spatial data**.

Modern technology has increased the ways in which geographers can obtain spatial data. Remotely sensed information from satellites that orbit the earth above the atmosphere and **aerial photography** (professional images captured from planes within the atmosphere) are important sources of observed data available today. Ground-level photography has replaced sketching as a tool for capturing information about landscapes. Sound recordings and the ability to get chemical analyses of air, water, and soil have also changed the way geographers observe a landscape.

Once data has been gathered, it must be interpreted. Geographers depend on their skills of synthesizing and integrating, or putting together, all of the collected information to better understand the place, area, or landscape being studied. A common example clearly observable today is the changes that occur in the landscapes of rural and urban areas over time. A geographer may be interested in understanding what changes are likely to occur as people move into or out of an area:

- Who are the people migrating into this area? Who is leaving?
- What are the cultures of these groups of people?
- What effects will the changes have on the local economy?
- What are the causes of people moving?
- What types of human-environment interaction are occurring?

The Built Environment

When we use the word *environment*, we usually think of nature and natural things. Plants, the air, water, and animals are all part of the natural environment. Human geographers often refer to the **built environment**, by which they mean the physical artifacts that humans have created and that form

part of the landscape. Buildings, roads, signs, and fences are examples of the built environment.

The architectural style of buildings varies from place to place. Think of typical homes and buildings in China, and then think of homes and buildings in Germany. These differences occur because people with different cultures living in different physical landscapes construct buildings, roads, and other elements to create a unique built environment. Anything built by humans is part of the **cultural landscape**.

Four-Level Analysis

One systematic way to study geographic phenomena is to use Four-Level Analysis. This method is summarized in the chart below.

FOUR-LEVEL ANALYSIS		
Level	**Description**	**Key Questions**
1. Comprehension	Establish the basic information clearly	• What? • Where? • When? • Scale?
2. Identification	Identify and describe patterns in phenomena	• Are phenomena connected?
3. Explanation	Explain how individual phenomena might form a pattern	• Why is something where it is? • How did something get where it is?
4. Prediction	Explain why a pattern is important, and predict what it might lead to	• So what? • What if? • What are the effects?

GEOGRAPHIC PERSPECTIVES: THINKING ABOUT DISTANCE

Geographers use the concept of distance to study the spatial distribution of phenomena. The perception of distance reflects context. Neighboring families in a small town in Iowa might live 50 feet apart. To a family in a high-rise apartment in Manhattan, 50 feet might seem like a long distance. To a family living on a ranch in Wyoming, miles from their nearest neighbor, 50 feet might feel uncomfortably close.

Time and Distance

In addition, what people consider a long distance changes over time. In the mid-1800s, Irish families held funeral-like ceremonies for emigrants

2

Patterns and Processes

The map—what a great idea!—is also one of the oldest and perhaps the most powerful and constant of geographic ideas. . . . Although they may be as beautiful as any work of art, we distinguish maps from art in the way we look at them. . . . The map's message does not lie in its overall effect but in the locational information it carries.

—Anne Godlewska, *Ten Geographic Ideas That Changed the World*

Essential Question: What tools and techniques do geographers use to analyze the world?

Geographers emphasize spatial **patterns**, general arrangements of things being studied, and the **processes**, the repeated sequences of events, that create them. Learning to recognize and use geographical patterns is a fundamental skill in understanding the discipline.

Maps

Maps are the most important tool of a geographer. No tool communicates spatial information more effectively than a map. They are essential in highlighting and analyzing patterns.

Scale

Nearly every map is a smaller version of a larger portion of the earth's surface. In other words, a map is a reduction of the actual land area it represents. **Scale** is the ratio between the size of things in the real world and the size of those same things on the map. A map has three types of scale: cartographic scale, geographic scale, and the scale of the data represented on the map.

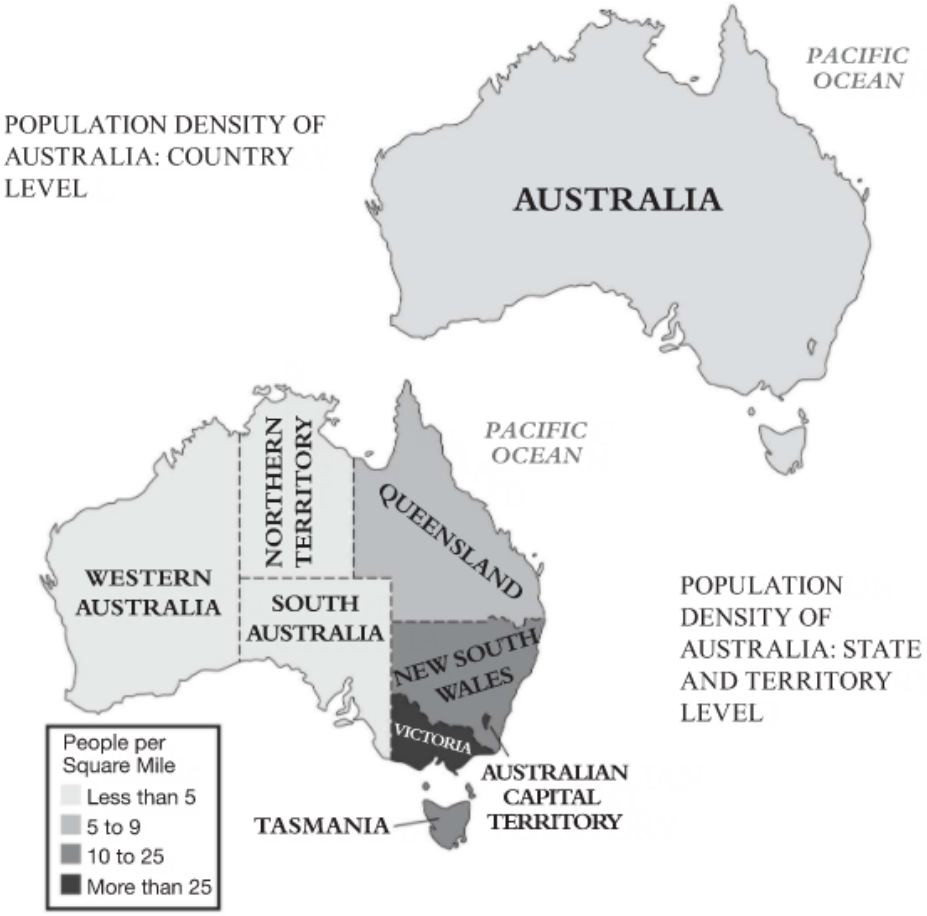
Cartographic scale refers to the way the map communicates the ratio of its size to the size of what it represents:

- Words: for example, "one inch equals ten miles." In this case, two and a half inches on the map would be 25 miles on the surface of the earth.
- A ratio: for example, 1/200,000 or 1:200,000. This means that 1 unit of measurement on the map is equal to 200,000 of the same unit in reality. For example, 1 inch (or centimeter or millimeter) on the map represents 200,000 inches (or centimeters or millimeters) on the ground.

- A line: for example, the map may show a line and indicate that its distance on the map represents ten miles in reality. This is sometimes called a linear, or graphic, scale.

Geographic scale, sometimes called **relative scale,** refers to the amount of territory that the map represents. For example, global scale means a map of the entire planet, and it is used to show data that covers the entire world. In contrast, local scale means a map of a city. It might be used to show finer details, such as school attendance boundaries. Geographers often zoom in and out of maps that use different scales in order to see the patterns that exist at each scale. In addition, the reasons patterns exist can often be explained differently depending on the scale of analysis. A rise in unemployment might be shaped by global forces at a global scale or by local forces at a local scale.

The **scale of the data** differs from cartographic or geographic scale. Compare the maps showing the population density of Australia. The scale of both maps is the same, but the scale of the data differs. One map shows the scale of data at the country level; the other, at the state and territory level. One map shows Australia as moderately populated throughout. The other shows that the country consists of large, sparsely populated areas and a few small, densely populated areas.



Reference Maps

There are two broad categories of maps: reference maps and thematic maps. **Reference maps** are aptly named because they are designed for people to refer to for general information about places:

- **Political maps** show and label human-created boundaries and designations, such as countries, states, cities, and capitals.
- **Physical maps** show and label natural features, such as mountains, rivers, and deserts.
- **Road maps** show and label highways, streets, and alleys.
- **Plat maps** show and label property lines and details of land ownership.
- **Locator maps** are illustrations used in books and advertisements to show specific locations mentioned in the text.

MEXICO

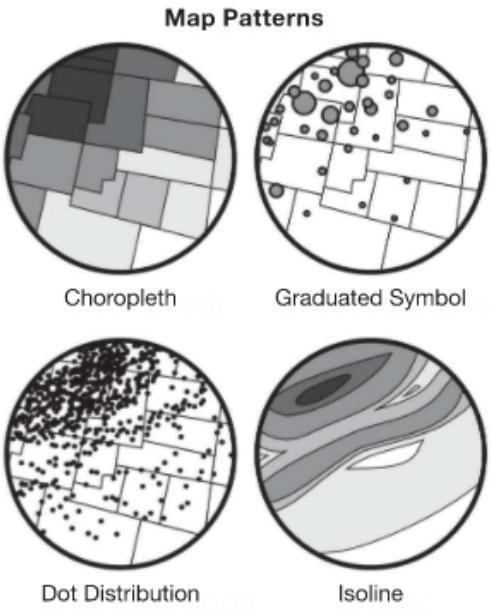
Thematic Maps

Thematic maps show spatial aspects of information or of a phenomenon. Following are descriptions of four common types of thematic maps.

Choropleth maps use various colors, shades of one color, or patterns to show the location and distribution of spatial data. They often show rates or other quantitative data in defined areas, such as the percentage of people in a country who speak English. The maps showing the population density of Australia are choropleth maps. As they demonstrated, the scale of data influences how the map looks.

Dot distribution maps are used to show the specific location and distribution of something across the territory of the map. Each dot represents a specified quantity. One dot might stand for one school building—or for millions of people who own dogs. While these maps are known as dot distribution maps, any kind of symbol—a triangle, the outline of a house, a cow—can be used instead of dots.

Graduated symbol maps use symbols of different sizes to indicate different amounts of something. Larger sizes indicate more of something, and smaller sizes indicate less. These maps make it easy to see where the largest and smallest of some phenomena are by simply comparing the symbols to each other. The map key is used to determine the exact amount. The symbols themselves are arranged on the map centered over the location represented by the data, so they may overlap. Graduated symbol maps are also called proportional symbol maps.

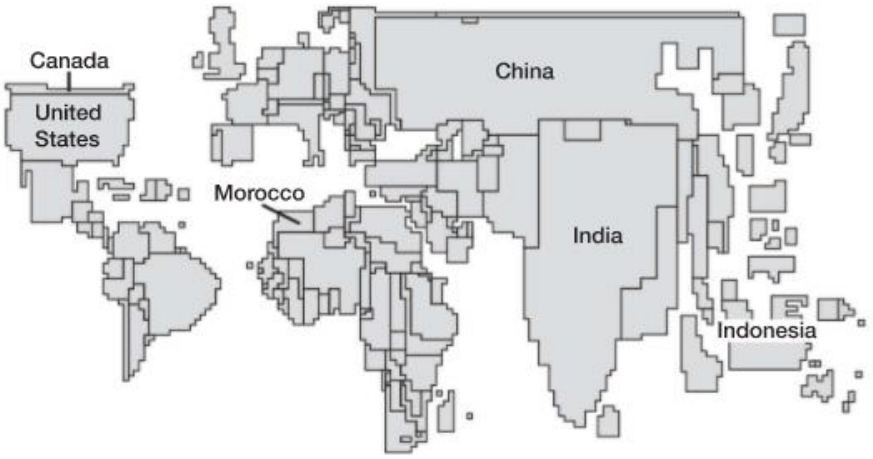


Isoline maps, also called isometric maps, use lines that connect points of equal value to depict variations in the data across space. Where lines are close together, whatever the map depicts is changing rapidly; where the lines are farther apart, the phenomenon is relatively the same. The most common type of isoline maps are **topographic maps**, which are popular among hikers. Points of equal elevation are connected on these maps, creating contours that depict surface features. Other examples of isoline maps are weather maps showing changes in barometric pressure, temperature, or precipitation across space.

Cartograms

In a **cartogram**, the sizes of countries (or states, counties, or another areal unit) are shown according to some specific statistic. In the example on the next page, the cartogram of world population shows Canada and Morocco as roughly the same size because they have similar populations (about 35 million people), even though Canada is more than 20 times larger in area. Any variable for which there are statistics can be substituted for the size of the country and mapped in the same way. Cartograms are useful because they allow for data to be compared, much like a graph, and distance and distribution are also visible, like on a traditional map.

WORLD POPULATION CARTOGRAM

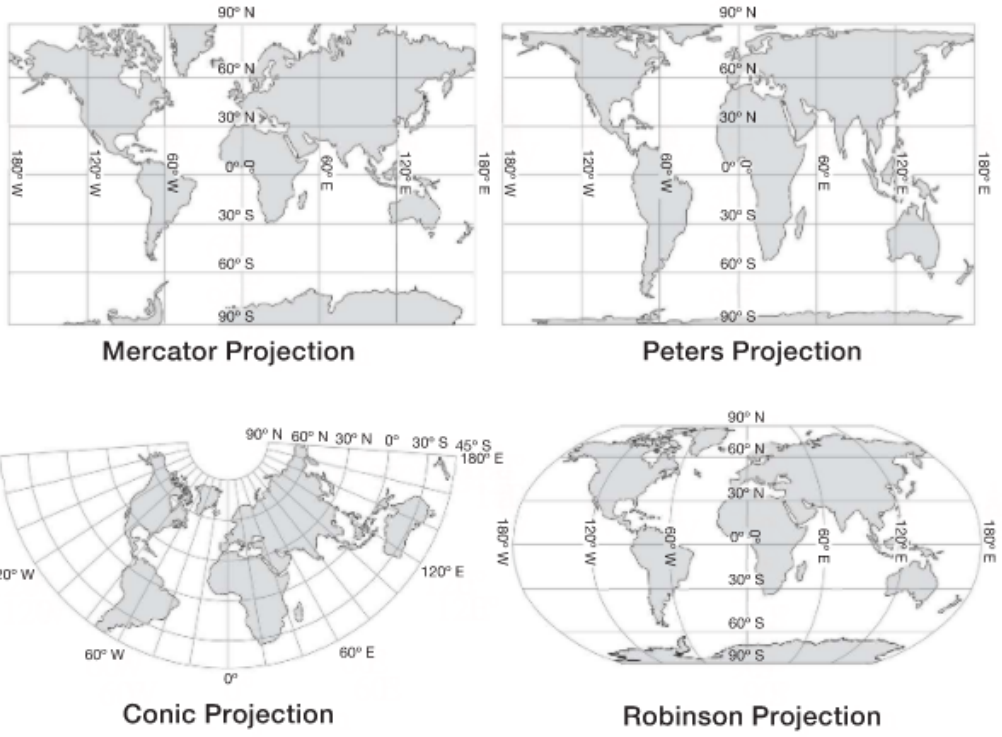


Projections

Because the earth is a sphere and maps are flat, all maps distort some aspect of reality. The process of showing a curved surface on a flat surface is done using a **map projection**. Cartographers decide whether they want to preserve area, shape, distance, or direction on their map accurately, knowing that other elements will have to be less accurate as the earth is "flattened" on their map.

COMPARING MAP PROJECTIONS

Purpose	Strengths	Distortion	Projection
Navigation	• Directions are shown accurately • Lines of latitude and longitude meet at right angles	• Distance between lines of longitude appears constant • Land masses near the poles appear large	Mercator
Spatial Distributions Related to Area	• Sizes of land masses are accurate	• Shapes are inaccurate, especially near the poles	Peters
General Use in Midlatitude Countries	• Lines of longitude converge • Lines of latitude are curved • Size and shape are both close to reality	• Direction is not constant • On a world map, longitude lines converge at only one pole	Conic
General Use	• No major distortion • Oval shape appears more like a globe than does a rectangle	• Area, shape, size, and direction are all slightly distorted	Robinson



Models in Geography

Geographers, similar to biologists, meteorologists, and others dealing with complex reality, create **geographic models**, representations of reality or theories about reality, to help them see general spatial patterns, focus on the influence of specific factors, and understand variations from place to place. Models help explain, describe, and sometimes even predict spatial activity and phenomena. There are two basic types of geographic models: spatial and nonspatial:

- **Spatial models** look like stylized maps, and they illustrate theories about spatial distributions. Spatial models have been developed for agricultural land use (the von Thünen model, Chapter 14), industrial location (least cost theory, Chapter 15), the distribution of cities (central place theory, Chapter 18), and the structure of urban areas (Chapter 19).
- **Nonspatial models** illustrate theories and concepts using words, graphs, or tables. They often depict changes over time rather than across space. Examples are the demographic transition model (Chapter 4) and Rostow's modernization model (Chapter 17). Wallerstein's world-systems theory combines elements of both spatial and nonspatial models (Chapter 17).

Formulas and Graphs

Geographers use mathematic formulas to help them understand how the world works. These formulas function much like models. Some formulas, such as those that determine crude birth and death rates, doubling times for populations, and population densities, are mathematical calculations that are used to produce a statistic. Other formulas, such as the one used in the rank-size rule (Chapter 18), produce results that are more theoretical, as is typical in a model. Graphs are used to illustrate population structures (population pyramids, Chapter 3), geographic concepts (distance-decay, Chapter 1), and even models (the demographic transition model, Chapter 4).

Use of Models

One of the most famous geographic models is von Thünen's model of land use. It was developed by a German farmer and economist, Johann Heinrich von Thünen, in the first half of the 1800s. The chart below shows how von Thünen's model, like all models, is a generalization, a simplification, and a theory.

RELATIONSHIP OF VON THÜNEN'S MODEL TO REALITY

Model Attribute	Application
Generalization from Reality	Von Thünen studied how farmers decided to use their land. For example, should they grow vegetables or raise cattle or plant fruit trees? Based on what people did, he developed a general model about agricultural land use.
Simplification of Reality	Von Thünen focused on two variables—transportation and distance—even though a farmer might be influenced by several other variables, such as the location of mountains and the fertility of the soil.
Theoretical Description of Reality	Von Thünen's model could be applied around the world. But since no other set of circumstances exactly matched the one he studied, his model would never exactly match reality. However, the differences between the model and reality can help geographers understand the reality more accurately.

Models are often mathematical formulas based on data, and people use them to make predictions. When reality varies from a prediction, geographers rethink the model. They ask: Why are things the way they are here and now? Why does this real situation differ from the situation that the model was based on? Models are never "wrong" or "right," but they can be more or less useful in understanding the world.

Regionalization and Regions

Regionalization is the process geographers use to divide and categorize space into smaller areal units. This is much like how a writer divides a book into chapters and then names (or classifies) them.

Types of Regions

Geographers classify regions into one of three basic types: formal, functional, or perceptual. **Formal regions**, sometimes called **uniform regions** or **homogeneous regions**, are united by one or more traits:

- physical, such as the Sahara, a vast desert in northern Africa
- cultural, such as southwestern Nigeria, an area where most people speak Yoruba
- economic, such as the Gold Coast of Africa (Ghana), which exports gold

Functional regions are organized around a focal point and are defined by an activity that occurs across the region. These regions are often united by networks of communication and transportation that are centered on a node. For this reason, they are also known as **nodal regions**:

- Pizza delivery areas are functional regions; the pizza shop is the node.
- A country is a functional region; the capital city is the political node.

A necessary part of any functional region is the flow of some phenomenon across the networks that unite the region, whether the flow is visible (cars delivering pizza using roads) or invisible (political and legal authority from the capital city).

Perceptual regions differ from formal and functional regions in that they are defined by the informal sense of place that people ascribe to them. The boundaries of perceptual regions vary widely because people have a different sense of what defines and unites these regions. The American "South," the Middle East, and "Upstate" New York are examples. While all of these regions exist, their exact boundaries depend upon the person who is defining them. Perceptual regions are also known as **vernacular regions**.

Similar to perceptual maps are **mental maps**, or the maps that people create in their minds based on their own experience and knowledge. Mental maps evolve over time. The mental map of a child entering kindergarten for the first day of class might be just a door, a classroom, and a playground. After a month, or a year, or several years in the building, the child will have a much fuller mental map.

World Regions

In the same way that historians divide history into eras and periods, geographers divide the world into regions and subregions. One type of large

region is a continent. However, dividing the world into continents is not simple. Are Europe and Asia two continents or one? Where is the dividing line between North and South America? Is Greenland its own continent?

Large Regions

The following map shows the ten large regions used in AP® Human Geography. It includes the seven continents that are based on physical features. It also includes three cultural regions that are based on shared languages and histories:

- Central America is part of North America but with a culture more influenced by Spain and Portugal than by Great Britain and France.
- Sub-Saharan Africa is distinguished from the rest of Africa.
- The Russian Federation spans eastern Europe and northern Asia.

WORLD REGIONS: A BIG PICTURE VIEW

Subregions

Geographers divide regions into smaller areas, or **subregions**. A subregion shares some characteristics with the rest of the larger region but is distinctive in some ways. For example, the region of Latin America covers parts of North and South America, from Mexico to Chile. Within it is the subregion of Brazil. As in other Latin American countries, most people in Brazil are Roman Catholics. However, Brazil's primary language is Portuguese, which makes it unlike any other country in the mostly Spanish-speaking Latin America. Because of its language, Brazil is a distinct subregion.

The map below shows the standard subregions used in AP® Human Geography. For example, Sub-Saharan Africa is subdivided into West, Central, East, and Southern Africa. Asia is divided into five subregions: Middle East, Central Asia, South Asia, East Asia, and Southeast Asia.

WORLD REGIONS: A CLOSER LOOK

Smaller Regions

By changing the scale and zooming in, subregions can be even further divided. The further subdivisions can be based on elements of physical geography, such as climate and landform, or human geography, such as culture, politics, or economics. Western Europe can be divided into Northwestern Europe and Southern Europe, each unified by more specific traits.

Since many kinds of regions exist, any one place is part of many regions or subregions at the same time. For example, Florida is part of

- a climate region based on its warm weather
- a cultural region known as the South
- an economic region known as the Sun Belt

Geospatial Data

Geospatial data includes all information that can be tied to a specific place. Besides locations of things, such as mountains or roads or boundaries, it includes human activities and traits. Where do speakers of Mandarin live? How common is poverty in each U.S. county? Where is the dividing line in a city between students who attend one high school and those who attend another?

Obtaining Geospatial Data

Much geospatial data is gathered in the field. This means that the data was observed and recorded on location, and the act of collecting it is known as

fieldwork. Important sources of this type of data can come from a census of the population, from interviews, or even from informal observations made by geographers. Land surveys, photographs, and sketches are also important ways in which this data is obtained. Technology is making the collection, accuracy, storage, analysis, and display of geospatial data easier than at any time in the past. The following chart illustrates three technologies that have revolutionized the importance of geospatial data.

GEOSPATIAL TECHNOLOGIES		
Type	**Description**	**Uses**
GPS: Global Positioning System	GPS receivers on the earth's surface use the locations of multiple satellites to determine and record a receiver's exact location	• Precisely locating borders • Navigating ships, aircraft, cars • Mapping lines (trails) or points (fire hydrants)
Remote Sensing	The use of cameras or other sensors mounted on aircraft or satellites to collect digital images of the earth's surface	• Determining land cover and use • Monitoring environmental changes • Assessing spread of spatial phenomena • Monitoring the weather
GIS: Geographic Information Systems	Computer system that can store, analyze, and display information from multiple digital maps or geospatial data sets	• Analysis of crime data • Effects of pollution • Transportation/travel time analysis • Urban planning

Quantitative and Qualitative Data

Geospatial data can be quantitative or qualitative. **Quantitative data** is information that can be measured and recorded using numbers. Some examples are the distribution of people by income or age group. Quantitative data is often used with geographic information systems because it lends itself to analysis using formulas and computers.

In contrast, **qualitative data** is not usually represented by numbers. This data is collected as interviews, document archives, descriptions, and visual observations. For example, asking people whether they feel that an intersection is dangerous is qualitative. Qualitative data is harder to analyze than quantitative data. People's perceptions, opinions, and reasons for doing things are important parts of human geography. This qualitative data contributes greatly to geographic understanding of places and the people who use them.

GEOGRAPHIC PERSPECTIVES: THE LONDON SUBWAY MAP

One of the most useful maps in history is also one of the most inaccurate. And its inaccuracies are what make it so useful. The map of the London subway system, known as the Underground, demonstrates the value of the concept of relative location. A portion of this map is shown below.

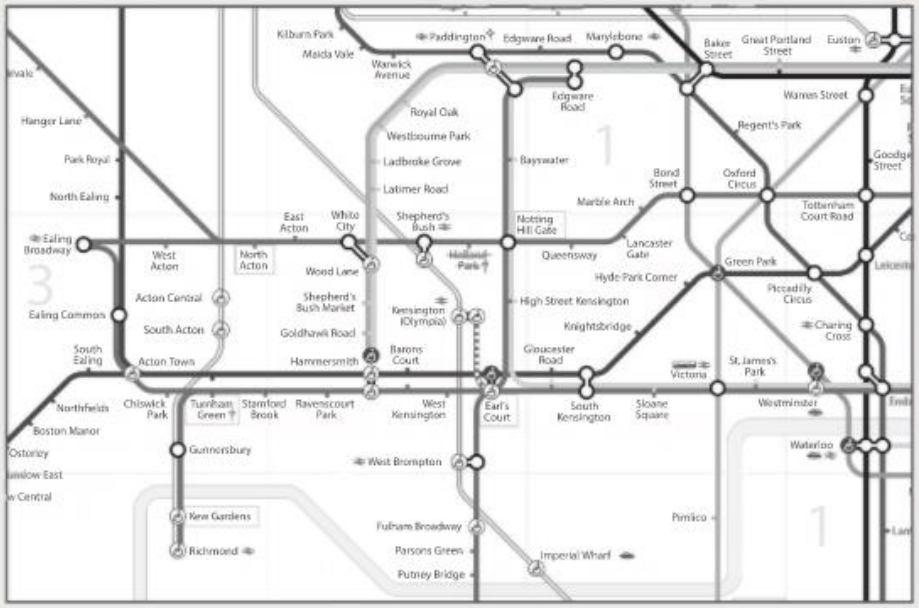
Beck's Map

By 1931, the Underground had become so complex that an accurate but conveniently small map was hard to read. Harry Beck, an Underground employee, realized that a simpler map would be more useful. Passengers did not need to know every twist and turn in the routes, so he created a map with straight lines. And passengers were not particularly concerned with distances, so he adjusted the space between stops on the map. He spread out the ones in the congested central city and reduced space between the outlying stops so they fit on the map easily.

The result was a map based on relative location that was easy to read and convenient to use. Passengers knew where to get on, where to get off, and at which stops they could transfer from one line to another.

Popular Demand

When the first version of the map was distributed to a few passengers in 1933, people demanded more. Since then, the map has been revised regularly to add new subway lines, more information about which lines have limited service, which stations are accessible to people using wheelchairs, and other improvements. Other transit systems have adopted a similar approach.



KEY TERMS		
patterns	choropleth maps	regionalization
processes	dot distribution maps	formal regions
scale	graduated symbol maps	uniform regions
cartographic scale	isoline maps	homogeneous regions
geographic scale	topographic maps	functional regions
relative scale	cartogram	nodal regions
scale of data	map projection	perceptual regions
reference maps	Mercator map projection	vernacular regions
political maps	Peters projection	mental maps
physical map	conic projection	subregions
road maps	Robinson projection	fieldwork
plat maps	geographic models	quantitative data
locator maps	spatial models	qualitative data
thematic map	nonspatial models	