Preface

Publishing a national atlas is the first step toward achieving the educational goal for students to understand their nation and its geography. In 2007, the National Geographic Information Institute published *The National Atlas of Korea* for the first time. Revisions of the atlas have been made to document and illustrate the rapid transformation of and changes to the land and the details of Korea’s physical and human environments.

As a national record, *The National Atlas of Korea* is an official reference for defining and explaining Korea’s territory and territorial water to the world. It is a valuable source of information for developing government policies for balanced national development, a necessary educational guide to promote an accurate understanding of the land, and a useful means of introducing dynamic changes and developments in Korea and Korean society to the world.

Reflecting a commitment to staying up-to-date and relevant, The National Geographic Information Institute presents *The National Atlas of Korea: Comprehensive Edition* as a useful educational resource for our adolescents to better understand their nation. I hope that *The National Atlas of Korea: Comprehensive Edition* becomes a valuable reference for our future generations to learn the value and importance of the nation. The National Geographic Information Institute pledges to continuously publish the most updated geographical information of Korea.

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Introduction − All Maps Are Not Created Equal

The task of reading a map is similar to reading a book or an essay in the sense that book readers should generally keep an open mind during the reading process and be ready to accept concepts and ideas presented by the author while maintaining a healthy skepticism of what is being written so that questions can be raised or an idea rejected if the reader does not agree with the author. Map reading should follow the same path. However, there is a fundamental difference between reading a book and reading a map. A book uses words, sentences, and paragraphs in a well-structured sequence to convey information and ideas of the central theme of the book. A map uses graphics and symbols on a surface (paper or digital display) to simultaneously present a symphony of complex spatial phenomena. These phenomena imply spatial relationships between map components or the map elements. Reading a map is not sequential like reading a book, thus, each map reader may have a different set of strategies or sequences for viewing different parts of the map than another map reader. In so doing, they may come up with different visions, interpretations, and conclusions about the same map. Many of us are too quick to accept the validity of a published map without questioning its truthfulness or accuracy. To this end, the Internet and any book or map publisher provide a common platform for maps created by both trained and untrained cartographers. A danger exists here when a teacher, or anyone, blindly accepts and adopts an erroneous map, published on the Internet or otherwise, for use in the classroom. Any mistake that may have been included in an erroneous map should not be passed on as fact to the students. Thus, it is important that teachers convey to students that all published maps are not necessarily accurate representations of the world. The intent of this section is to systematically and clearly outline many of the fundamental concepts on how maps are created from the cartographer’s perspective, and to provide some clues on how a reader should interpret and analyze them. All individual maps are different and there is no single magic formula that will clearly or definitively indicate “this map is wrong” or “that map is well constructed.” Each evaluation will have to be entirely based on the specific contents of the map itself, the integrity of the data used to construct it, and on how well it was designed and presented. Thus, all maps are not created equal. In this respect, the map is perhaps more subject to interpretation than a book would be. The very nature of the map itself is a complex matter as it represents a vast stretch of space and a large number of different spatial relationships. With this section, the authors attempt to briefly introduce the nature of the map in simple terms, and provide insight into the many decisions that a cartographer has to make. Specific examples shall be used to provide guidelines for teachers to consider when determining the pedagogic value of a particular map or group of maps. Since it is impossible to write about all cases and scenarios, this section is meant to invoke the student’s nature of maps and the possible and embedded spatial information that a map can convey, however simple it may appear. The test of this section shall be systematically organized by various topics to provide a synopsis of the very fundamental concepts about maps to assist readers in using this atlas.

Core Skills: Interpreting and Understanding Maps

Core Skills: Interpreting and Understanding Maps

Major Types of Maps

Various authors have categorized different types of maps in alternative ways. However, there are several distinct broad types of maps. Some may fall into more than one type in this classification. There may also be some maps that do not fit into these types. Nevertheless, each type is clearly distinguishable from another because of their properties and intended functions.

- **Reference Maps** – The primary function of reference maps is for locating specific places. Each reference map has at least one complete set of coordinate grids, including a geographic coordinate system such as latitude and longitude, or the Universal Transverse Mercator (UTM) grid system, or in the case of the United States, the State Plane Coordinate System. Latitudes, also called parallels, are lines drawn horizontally around the globe that are parallel to the Equator. They reduce in length as they approach the poles. For example, 90° N Latitude and 90° S Latitude are actually points instead of lines (the North and South Poles). Both Korea and the United States are situated north of the Equator and are therefore designated with North Latitudes. Australia, on the other hand, is situated south of the Equator and thus designated with South Latitudes. Longitudes, also called meridians, are lines drawn vertically on the globe and each one runs through both the North and South Poles. The Prime Meridian, or 0° Longitude, at the Greenwich Observatory just outside London, England was recognized as an international standard as a result of The International Meridian Conference held in Washington, D.C. in 1884. It sets a reference for all other longitudes, up to 180° East or West. Korea is situated to the east of the prime meridian and its location is therefore designated in East Longitudes; the United States, however, is situated to the west of the prime meridian and its location is therefore designated in West Longitudes. When a longitude runs through the North Pole and descends on the opposite side of the globe, it then constitutes a great circle. Great circles divide the globe into equal halves. The Equator is also a great circle because great circles do not have to pass through either Pole.

- **There are many other lesser known grid systems because almost every country in the world defines their own local reference system. Topographic maps are the most popular reference maps. All the maps in Chapter 5 of the National Atlas of Korea I (Choe, 2014) are reference maps. The degree of accuracy of reference maps is generally higher than most other kinds of maps because they are produced through photogrammetric, surveying, and GPS-based methods and are generally made at a larger scale than most other types of maps. Some of these reference maps are so accurate that civil engineers use them to assist in building roads, bridges, and other kinds of infrastructures. Of course, the scale at which these maps are made also decide the degree of accuracy. Some atlases can also be considered reference maps even though they may not be as accurate as topographic maps simply because they record as many place features complete with their names for reference purposes.**

- **Cadastral Maps** – Cadastral maps are very large-scale maps generally created by local governments, particularly in the United States, to record ownership of land parcels. These are carefully surveyed maps made by various authors have categorized different types of maps in alternative ways. However, there are several distinct broad types of maps. Some may fall into more than one type in this classification. There may also be some maps that do not fit into these types. Nevertheless, each type is clearly distinguishable from another because of their properties and intended functions.

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professional surveyors that show great local detail so that the boundaries of parcels can be clearly delineated and identified. In the past, parcel maps were kept primarily in counties and were rarely used. Today they are easily accessible, used, and re-recorded because of the sale of properties. Many digital maps can also be used to determine the amount of tax that should be levied on a property based on its location, size, and value. One of the main reasons why digital mapping is so valuable is that it can show the location and boundary lines of property. Today, most counties in the United States have converted their old paper maps into digital format so that they can be retrieved and updated easily.

Many digital maps are created so that you specifically created to guide you from one place to another. They provide us with clear directions to the nearest and most relevant destinations. When we travel by land, over water, or in the air, these maps can help us navigate. For example, they can help us find the distance between two points, the time it will take us to get there, and the best route to take. Maps are also useful in creating plans and maps that are used in our daily lives. For example, the United States Geological Survey (USGS) has a collection of topographic maps that are used by many different organizations, including the military, the National Park Service, and the Federal Emergency Management Agency.

Digital maps are also used to create thematic maps, which are maps that show the distribution of a particular feature or phenomenon. These maps can be used to study a wide range of topics, from the distribution of natural resources and natural hazards to the distribution of human activities and social phenomena. Digital maps can also be used to create cartograms, which are maps that distort the size of regions to represent different variables, such as population or income. For example, the United States is shown as much larger than China because it has a larger population.

The Earth Is Not (Perfectly) Round

In order to have maps made accurately, cartographers need to know the exact shape of the earth. The axis of the earth is the line that runs from the North Pole to the South Pole. The equator is the line that runs around the earth at the middle of the earth. The earth is not a perfect sphere, but it is slightly flattened at the poles and bulging at the equator. The earth is approximately an ellipsoid, which means that it is shaped like a rugby ball. The earth's radius at the equator is about 6,378.1 kilometers, and the radius at the poles is about 6,356.8 kilometers.

To create a map, cartographers must determine the shape of the earth. They do this by using a mathematical model of the earth, such as the World Geodetic System 1984 (WGS 84) or the Universal Transverse Mercator (UTM) projection. These models are used to transform the shape of the earth into a two-dimensional map.

Maps Can Be Accurate or Inaccurate

Maps can be accurate or inaccurate. An accurate map is one that accurately represents the shape of the earth and the locations of features on the earth. An inaccurate map is one that does not accurately represent the shape of the earth or the locations of features on the earth. Accuracy is important because inaccurate maps can lead to incorrect conclusions and decisions.

A functional map-making and mapping information communication model

In the context of map-making and mapping information communication, a functional map-making and mapping information communication model is one that can effectively communicate the information contained within a map. This model should be able to convey the necessary information in a clear and concise manner, while also being easy to understand and interpret. The model should also be able to adapt to different situations and contexts, and should be able to be used by people with different levels of expertise.

Conclusion

In conclusion, maps are an important tool for understanding and communicating information about the world. They are used in a wide range of fields, from geography and environmental science to urban planning and transportation. Maps can be created in a variety of ways, from traditional cartography to modern digital mapping. The key to creating effective maps is to choose the right type of map, and to make sure that the information presented is clear and accurate. By doing so, we can ensure that maps are a valuable tool for understanding and communicating the world around us.
The map on the left appears on Page 82 of the National Atlas of Korea I with the title "New Industrial Production Bases with Backward Region Boundary Superimposed". A map is the product of many activities (including, but not limited to topographical production, planning, and land use). The map is the result of the cartographer's work and is intended to provide a visual representation of the real-world data. The map is a tool for communication, enabling the map reader to understand the intent of the map creator. The cartographer's goal is to make the map as clear and as easy to understand as possible, while still conveying the necessary information.

The map on the right is a thematic map that shows the distribution of data according to a specific variable. The map legend indicates the type of data represented on the map, such as population density, land use, or economic activity. The map legend is crucial for understanding the map, as it provides a key to interpreting the symbols and colors used on the map. The map legend should be clear and concise, with distinct symbols and colors that are easily recognizable.

The map on the middle is a topographical map that shows the physical features of the area, such as mountains, rivers, and roads. The map is a valuable tool for understanding the landform and the natural environment. The map is also useful for planning and decision-making, such as for infrastructure development or environmental protection.

The map on the bottom is a thematic map that shows the distribution of data according to a specific variable, such as temperature or precipitation. The map is a valuable tool for understanding the spatial patterns and trends in the data. The map is also useful for planning and decision-making, such as for resource management or climate change adaptation.

The table below summarizes the map features and their purposes:

<table>
<thead>
<tr>
<th>Map Feature</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map title</td>
<td>Identification of the map</td>
</tr>
<tr>
<td>Map legend</td>
<td>Interpretation of the symbols and colors</td>
</tr>
<tr>
<td>Map scale</td>
<td>Scale of the map</td>
</tr>
<tr>
<td>Map symbols</td>
<td>Representation of data</td>
</tr>
<tr>
<td>Map color</td>
<td>Visualization of data</td>
</tr>
</tbody>
</table>

The cartographer's role is to create a map that is both informative and visually appealing. The cartographer must be able to interpret the data, select the appropriate symbols and colors, and arrange them in a way that is easy to understand.

The cartographer's goal is to make the map as clear and as easy to understand as possible, while still conveying the necessary information. The cartographer must be able to interpret the data, select the appropriate symbols and colors, and arrange them in a way that is easy to understand. The cartographer must also be able to communicate the map's purpose and the data it represents to the map reader.

The cartographer's work is essential in providing a visual representation of the real-world data. The map is a tool for communication, enabling the map reader to understand the intent of the map creator. The cartographer's goal is to make the map as clear and as easy to understand as possible, while still conveying the necessary information.
of introducing error to maps. It is up to the map reader to use these errors to attain a greater understanding of the meaning of the maps.

• Measuring error: many of today’s maps are based on computer and statistical modeling methods. In measuring a statistical surface (a land surface or a spatial surface filled with continuous data), many modeling methods such as Kriging, Splines, Polynomial, Inverse Distance to the Power, Spline Method, Nearest Neighbors, and many more can be applied. Each method has its own unique mathematical requirements and can result in different results at each yield different results, but some are more appropriate than others to the viewer or user. A viewer may see a television broadcast map of wind patterns, those patterns have been “modeled” to fit the viewer’s appropriate modeling methods.”

• Misperception error: interpreting a map that is out- dated; a lot of changes could have taken place during an elapsed time period.

• Scale error: using an inappropriate scale for the purpose of the map.

• Symbol placement error: a map symbol being placed in the wrong part of the map.

• Distance discrimination error: a topographic map distance is orthogonal (a flat plane as its base, also technically referred to as planimetric) while its continuous numeric elevation. Because of these, a viewer may not notice that the broadcast map of wind patterns, those patterns have been “modeled” to fit the viewer’s appropriate modeling methods. The viewer may not notice the appropriate modeling methods. The viewer may not notice that the broadcast map of wind patterns.

• Perceptional error: reading off the wrong symbols or map legends from the map, or misinterpreting the title and symbols.

• Symbol elimination: omitting relevant ones can affect the outcome of the map.

• Generalization: there is a fine line between generalization and generalization routine (such as smoothing) can lead to a greater actual distance than the orthogonal or planimetric distance. This section is intended to provide only some of the more common examples of map errors in an attempt to demonstrate the errors and the complexities of creating thematic maps and the equally complex circumstances in their interpretation. Thematic maps are not necessarily categorized as qualitative or quantitative.

• What is the proficiency or ability of a student’s geographic education? This is an area of study that is mostly qualitative. Though there are many maps and so many ways a cartographer can make it so, there are also many potential errors in the interpretation process. Some of the common, unmotivated miss the analysis of the logic behind title, legend, scale, data, mapping method, and visual presentation. Experienced cartographers and map designers manage a symbology of all component parts of the creation of a map. As a reader, adding some revelation to the cartographer’s gauge, there may be a reader can have a general, or even specific, knowledge about what is being mapped or an understanding of the topics.

• Perusal: applying the element of geographic knowledge as an aid to read maps. This practice is also included as one of the few examples provided below to illustrate this connection.

Resolution change: Resolution is the size of the smallest unit of data that can be resolved in a set of data and recalculated population density based on their absence of population. Then he combined these two methods. A few features in nature have straight lines or sharp corners; therefore, a lot of changes could have taken place during an elapsed time period.

Visualizing the concentration or sparseness of hot spots of some feature on the map? The answer is yes. In a city and they will create a statistical surface of carbon elevation. The elevation of a point is considered as the third coordinate in a three-dimensional coordinate system. One way to determine the cartographer’s gauge, there may be a reader can have a general, or even specific, knowledge about what is being mapped or an understanding of the topics. Applying the element of geographic knowledge as an aid to read maps. This practice is also included as one of the few examples provided below to illustrate this connection.

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A major characteristic of the isoline map is that it represents a continuous surface where any data point in between two isolines can be interpolated with a relatively high degree of accuracy. Unlike the contour representation of land elevation, isoline maps employ the same technique of generating isolines; however, the value in between isolines cannot be precisely determined. In such a case, an average or interval value can apply.

Map A below is an actual map from a real estate website depicting properties that were listed for the City of Montgomery, Texas on the shores of Lake Conroe. Each house lists a specific asking price in thousands of dollars. The individual data points are re-drawn on Map B thus showing a statistical surface, but with one data point for a commercial property listing at $4.5 million. Four isoline maps depicting house prices are generated using the ‘spline interpolation’ method, each with a different parameter. It is apparent that all four have different patterns.

The isolines for Maps C and D were generated with a different computer routine without regard to the geographic reality that the shoreline is there. The routine assumes the extensions of the isolines over the lake. Map C also included the presence of the commercial property, which definitely skews the real estate asking price pattern. This data for this property was deleted to generate only the residential properties for Map D.

The isolines Maps E and F were generated by using the shoreline as a barrier such that no isoline will cross over the shoreline into the lake area where there is actually no data point. The resulting maps are more realistic. The data point for the commercial property on Map E was purposely left remaining just to show how one data point can skew the entire isoline pattern. Map E is the ideal one for this dataset since the shoreline barrier is applied and the commercial property deleted.

The Interpolation Process

A method of mapping densities of population with Cape Cod as an example.

The isoline maps represent a continuous surface where any data point in between two isolines can be interpolated with a relatively high degree of accuracy. Unlike the contour representation of land elevation, isoline maps employ the same technique of generating isolines; however, the value in between isolines cannot be precisely determined. In such a case, an average or interval value can apply.
While the average map reader may not realize how the dot map was created, the cartographer certainly carries a great deal of responsibility in making the best selections and decisions. Sound decision present the dot map with its best chance to communicate an accurate geographic pattern of population to the map reader. There is yet another level of difficulty for making a dot map, which relates to the placement of the dots. Suppose the dot value on a dot map is 1,000 people. As small as the size of one dot symbol may be, it is highly unlikely that all 1,000 persons live in a space at the placement of one dot, let alone all the dots in the entire map. In order to be accurate, the cartographer must have detailed knowledge of the area being mapped into dots and needs to exercise sound judgment to place the one dot in the centroid (center of gravity) of the clustered location of these 1,000 persons that the dot represents. Map readers need to understand this. While the production of the dot map is straightforward, the amount of research required to accurately place the dots in their proper locations can be tremendous and time-consuming. This is one reason why there are far less thematic maps portrayed as dot maps than other kinds of mapping methods.

A map design element comes into play here: the selection of the size of each dot symbol. Dot density will vary differently on the same map simply by changing the size of the dots, as hundreds or thousands of dots may appear on a map. If the dot size is too small, it may not convey a desirable “look” for the density. If the dot size is too large, dots may coalesce and impede the visual process and give the reader a false mental perception of the true density. The ultimate goal here is to convey a realistically portrayed geographic pattern of the population data over a geographic space.

The value of a dot map, when mapped properly, can show effectively the concentrations and sparseness of the population data even across a space. The graduated symbol map is a variation of the dot map where the location of the symbol, size to reflect the magnitude of the data, is a more detailed but less cluttered method of showing a set of spatial statistics. The symbol, normally a circle, is sized by the area of the symbol to represent a set scale of the data points. The tricky part about the construction of the circle size is that people often tend to forget that visualizing area is the main concern and since the area of a circle (A) is equal to πr², the radius of the circle is then √(A/π). The mistake of not taking the square root of (A/π) as the radius of the circle has been known to occur frequently on published maps; this causes an improper size representation of the data. The map reader should always be aware of this kind of error when viewing a graduated symbol map.

Further breakdowns of a total population data subset (such as different ethnic groups that make up 100% of a population) can be achieved with the graduated circle method. Circles can be proportionally sized to represent the data subset based on the degrees of a circle that represent a percentage (360 degrees represents 100%). In this respect, more than one variable can be shown simultaneously on the same graduated circle map. A map with more than one variable is called a choropleth map. With more than two variables are considered multivariate maps. However, the more variables a cartographer incorporates on one map, the more difficult it becomes to interpret and discern a geographic pattern.

A choropleth map: A choropleth map is a thematic map where data collection is based on pre-established area units, cartographically referred to as mapping units. These units have pre-established boundaries, such as a county, state, province, census block, or school districts. Data are collected on attributes (such as population, housing units) to cover the entirety of the mapping units. In other words, a population tally for one county will include every person who lives within that county’s boundaries. As much as the cartographer knows which part of the country. The U.S. Population 2000 map shows two maps of population of the United States: one based on state boundaries (upper right) and the other on county boundaries (map).
The three different population density patterns are explained in the following text.

Equal intervals

Quantiles, quartiles, and quantiles are used in cartography to create thematic maps with equal intervals. Equal intervals are used when the data range is divided into equal segments. This method is used when the data distribution is not skewed.

Quantiles are divided into four equal parts, while quartiles are divided into three equal parts. Quantiles are used when the data distribution is skewed, while quartiles are used when the data distribution is normal.

Equal intervals are used when the data range is divided into equal segments. This method is used when the data distribution is not skewed.

Equal intervals can be used to create maps with equal intervals. For example, the map of Wisconsin counties is divided into four equal intervals.

Decision making

The decision to use equal intervals is based on the cartographer's judgment of the data distribution. Equal intervals are used when the data distribution is not skewed. In other words, equal intervals are used when the data distribution is normal.

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The decision to use equal intervals is based on the cartographer's judgment of the data distribution. Equal intervals are used when the data distribution is not skewed. In other words, equal intervals are used when the data distribution is normal.

Equal intervals are used when the data range is divided into equal segments. This method is used when the data distribution is not skewed.

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