

UC Santa Barbara

GIS Core Curriculum for Technical Programs (1997-1999)

Title

Background: Geography for GIS

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Peer reviewed

Geography for GIS

Written by Robert Slobodian
Malaspina University-College, Nanaimo, British Columbia

[Geography for GIS Table of Contents](#)

[Note: outdated links have been removed]

Context

The operations in GIS appear to be largely technical in nature. It is important for the GIS operator and the consumer of GIS products to be aware of the geographical concepts that underpin GIS operations.

Geography is the study of the spatial patterns planet and the processes that contribute to those patterns. Two statements about the study of geography that give a quick introduction to the discipline. William Pattison's 1964 *Journal of Geography* article on "The Four Traditions of Geography" suggested the spatial tradition, area studies tradition, man-land tradition, and the earth-science tradition as the cornerstones of the discipline. A 1986 AAG-NCGE publication favors five themes; location, place, human/environmental interaction, movement, and regions as a more useable framework. The differences between the two schemes are not significant to most students.

What is significant, however, is that the student should understand that the jargon of a discipline is designed to be enabling to facilitate communication. Concepts are abstractions that enable the organization of knowledge. The geographical concepts are inherently spatial in nature, that is, they relate to places, spaces, and interactions.

Learning Outcomes

The following list describes the expected skills which students should master for each level of training, i.e. Awareness/Competency/Mastery.

Awareness is demonstrated by being able to define each concept.


Competency is demonstrated by being able to add to each definition an application of the concept.

Mastery is demonstrated by being able to add an innovative application, that is, one not covered in previous materials.

Resources

Pattison, William. "The Four Traditions of Geography" *Journal of Geography* 63(1964): 211-216.

AAG-NCGE, "Guidelines for Geographical Education, 1986



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Geography for GIS

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SECTION ORGANIZATION		
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WEBLINKS: EXPLANATION AND EXAMPLES		
TEXT REFERENCES		
	Christofferson	
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TEXT REFERENCES	
Authors	Title
Christopherson, R.W	Geosystems: an introduction to physical geography
	1997 3rd Edition, , Upper Saddle River, NJ: Prentice-Hall
deBlij, H.J., and Muller, P.O.	Geography: realms, regions, and concepts
	1994 7th Edition, New York: John Wiley and Sons
Fellman, J., Getis, A., and Getis, J.	Human Geography: landscapes of human activities
	1997 5th Edition, Dubuque, IA: Times Mirror
Knox, P.L., and Marston, S.L.,	Places and Regions in Global Context: human geography
	1998 Upper Saddle River, NJ: Prentice-Hall
McKnight, T.L.	Physical Geography: a landscape appreciation
	1992 4th Edition, Upper Saddle River, NJ: Prentice-Hall

Rubenstein, J.M.		The Cultural Landscape: an introduction to human geography
	1998	6th Edition, Upper Saddle River, NJ: Prentice-Hall



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SPATIAL DESCRIPTION

An initial description of the image represented - an orientation.

SPATIAL DESCRIPTION	
	Location
	Geographic Site
	Geographic Situation
	Mathematical Location
	Toponyms
	Direction
	Scale
	Distance
	Spatial Elements
	Mapping Physical Space
	Mental Mapping: Psychological Space and Distance



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CONCEPT NAME

- Location

DEFINITION AND EXAMPLES

- This fundamental concept provides identification for places in the field of study that keys its investigation to the question "where" and in relation to "what". Location gives a sense of place.

Four ways Geographers can relate location:

		Geographic Site
		Geographic Situation
		Mathematical Location
		Toponyms



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CONCEPT NAME

- **Geographic Site**

DEFINITION AND EXAMPLES

- **Definition of Site**
 - refers to the actual space occupied
- **Example of Site**
 - Mount St Helens National Volcanic Monument occupies a 110,000 acre (44,500 ha) site in Washington State

WEBLINKS: EXPLANATION AND EXAMPLES

- Link to Slippery Rock University for further information on - **Geographic Site**

TEXT REFERENCES

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CONCEPT NAME

- **Geographic Situation**

DEFINITION AND EXAMPLES

- **Definition of Situation**
 - nominal location, illustrates how one place is related to others and is not viewed in isolation
- **Example of Situation**
 - Mount St Helens is a volcanic peak located in the Cascade Mountain Range which itself is a product of tectonic action of the North American and Juan de Fuca plates

WEBLINKS: EXPLANATION AND EXAMPLES

- Link to Slippery Rock University for further information on - **Geographic Situation**

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CONCEPT NAME

- **Mathematical Location**

DEFINITION AND EXAMPLES

- **Definition of Mathematical Location**
 - a precise statement of location using a system of measurement
 - usually from a defined point of origin and using a framework of coordinates.
- **Examples of Mathematical Location**

Three Locational Systems indicating the location of Mount St. Helens

Latitude and Longitude System

- 46 degrees, 15 minutes North Latitude
- 122 degrees, 10 minutes West Longitude

Universal Transverse Mercator System(UTM)

- UTM Zone - 10T
- Easting 3,082,000
- Northing 6,312,000

American Automobile Association Alpha-numeric System(Tourist Road Maps for Washington State)

- row "O" & column "16"

WEBLINKS: EXPLANATION AND EXAMPLES

- Link to Slippery Rock University for further information on - **Mathematical Location**

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CONCEPT NAME

- Toponyms

DEFINITION AND EXAMPLES

- **Definition of Toponyms**

- place names - identification - may also give clues to human activity at that location

- **Examples of Toponyms**

- Captain Vancouver renamed the mountain called by the aboriginal people, Loo Wit Lat Kla, to Mount St. Helens. He changed the name to honor Britain's ambassador to Spain, Lord Alleyne Fitzherbert, Baron of St. Helens.

Toponyms as clues to settlers and may be a key to defining the region itself

Classical	Athens, Georgia (& Ont)	Sparta, Ontario (& Miss.)	Rome, New York	
Aboriginal Names	Manhattan	Minnesota	Manitoba	Seattle
European	NW Europe	New England,	New Orleans	British Columbia
	SW Europe	San Antonio	Las Vegas	Colorado
	Other European	Sitka, Alaska	Sebastopol, California	New Sweden, Minnesota
Other	China Lake,	Moscow,		

International	California	Kansas	Cairo, Georgia	
Personal	Washington	Columbus	Vancouver	Pennsylvania
Geographic Description	Hot Springs, Ark	Crater Lake, Ore	Salt Lake City, UT	Tros-Rivieres, Que

WEBLINKS: EXPLANATION AND EXAMPLES

- Link to Slippery Rock University for further information on - **Toponyms**
- Link to Professor Peterson's commentary on - **Toponyms**

TEXT REFERENCES

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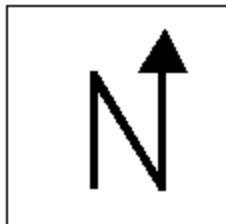
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CONCEPT NAME

- Direction

DEFINITION AND EXAMPLES

- Orientation with respect to a fixed point, such as the North Pole or "a point 2 km beyond the east coast"
- How a point in space relates to others, if not a physical path, a point of view or vantage point.
- People in western counties usually assume that the top of a map is oriented north unless there is some reason for a different alignment.
- Unfortunately the "north = top" assumption is frequently altered. Not all map makers are professional cartographers and don't recognize the convention.
- Many times irregular shaped features are placed out of kilter to fit a rectangular sheet.
- To reduce confusion an indicator of direction(usually a northpoint) is preferred.



WEBLINKS: EXPLANATION AND EXAMPLES

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CONCEPT NAME

- **Scale**

DEFINITION AND EXAMPLES

- Answers the question "What portion of earth space are we viewing?" Without scale we don't know what portion of the surface of the earth we are examining. The ratio between the representation image and the portion of the world represented. Even if the map will only be used by those intimately familiar with the area represented a scale needs to be indicated as good cartographic practice. You just never know the future uses for your map.
- Without scale the observer is at a real disadvantage to interpret an illustration.
 - Is it an outline that of Bolivia?
 - Is it the borders of New Brunswick?
 - Is it Terrebonne Parish in Louisiana?
 - Is it a rock in Tokyo Bay that is only visible at low tide?
- The most precise portrayal of scale is as a Representation Fraction(most often without units)
- A scale of 1 inch to 1 mile may be meaningful in the U.S. but 1:63,360 is meaningful world-wide.
- A bar scale does not have the precision of an Representative Fraction but is a good visual device as it will grow and shrink as the map gets modified

WEBLINKS: EXPLANATION AND EXAMPLES

- Link to the University of Texas' Geographer's Craft Project for further information on - **Scale**
- Link to the United States Geological Survey for further information on - **Scale**
- Link to the Mining Company's Geography Guide for further information on - **Scale**

FIRST

PRINT THESE PAGES FOR THE SCALE CONCEPT - USE "LANDSCAPE" PRINTING

THEN

LINK TO WATERTON LAKES NATIONAL PARK FOR A SELF-GUIDED EXPLORATION OF - SCALE

CLICK ON THREE DIFFERENT VIEWS OF WATERTON NATIONAL PARK

(Canadian portion of Waterton-Glacier Park)

Image 1 -- North America Map	
Locate the park in North America north of Montana along the Canada/US border	
On a 15" monitor, the portion of the image from the Pacific Ocean to Lake Superior is approximately 5.08cm long (2 inches)	
The distance in reality is approximately 2540 kilometers (1578.28 miles)	
ratio = map measurement x real world distance x conversion	
International Calculation	U.S. Calculation
ratio = 5.08 cm to 2540 x (100x1000 cm in a kilometer)	ratio = 2" to 1578.28 miles x (5280x12 inches in a mile)
ratio = 5.08 to 2540 x (100,000)	ratio = 2 to 1578.28 x(63,360)
ratio = 5.08 to 254,000,000	ratio = 2 to 100,000,000(approx.)
ratio = 1 : 50,000,000	ratio = 1 : 50,000,000
Therefore the scale of this map is approximately 1:50,000,000	

Image 2 - Waterton Glacier Park Area Map	
On a 15" monitor, the portion of the park image along the top of Montana is approximately 3.3cm long(1.3 inches).	
The distance in reality is approximately 83.7kilometers(52miles)	
ratio = map measurement x real world distance x conversion	
International Calculation	U.S. Calculation
ratio = 3.3 cm to 83.7 x (100x1000 cm in a kilometer)	ratio = 1.3" to 52 miles x (5280x12 inches in a mile)
ratio = 3.3 to (83.7 x 100,000)	ratio = 1.3 to (52 x63,360)
ratio = 3.3 to 8,370,000(approx.)	ratio = 1.3 to 3,294,720(approx.)
ratio = 1 : 2,534,400(approx.)	ratio = 1 : 2,534,400(approx.)
Therefore the scale of this map is approximately 1 : 2,534,400	
NOTICE : "The larger the detail -- the smaller the number"	

Image 3 - Clickable Waterton Park Village Map	
On a 15" monitor, the width of the image is approximately 16.5 cm wide(6.5 inches).	
The scale of the map distance is approximately 1 : 10,000	
real world distance = map measurement / conversion x scale	
International Calculation	U.S. Calculation
distance = 16.5cm /100000(cm per km) x 10,000	distance = 6.5 in / 63360(inches per mile) x 10,000
distance = .000165 x 10,000	distance = .0001025 x 10,000
distance = 1.65	distance = 1.026(approx.)
The distance represented by the width is 1.65 kilometers	The distance represented by the width is 1.026 miles

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CONCEPT NAME

- **Distance**

DEFINITION AND EXAMPLES

- A measurement between places. Usually distance is related as a physical measurement such as kilometers(miles) and meters(yards), but other measures of distance may be used: time, cost, or convenience.

WEBLINKS: EXPLANATION AND EXAMPLES

- Link to the University of Texas' Geographer's Craft Project for further information on - **Distance**
- Link to Slippery Rock University for further information on - **Distance**

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CONCEPT NAME

- **Spatial Elements**

DEFINITION AND EXAMPLES

- The building components of mapping. Kevin Cox reduced the conceptualization of maps to a set of five geographic elements:
 - nodes
 - paths
 - areas
 - landmarks
 - edges
- The spatial elements take form as Cartographic and GIS mapping primitives:
 - points
 - lines
 - polygons

WEBLINKS: EXPLANATION AND EXAMPLES

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CONCEPT NAME

- **Mapping Physical Space**

DEFINITION AND EXAMPLES

- Good spatial communication is not accidental, it is a matter of recognizing and applying cartographic principles.
- Qualities of a GOOD map.
 - Title
 - Direction
 - Scale
 - Legend
 - Margin
 - Neatline(field)
 - Publication Data
 - Publisher name
 - Publication Date
 - Projection

WEBLINKS: EXPLANATION AND EXAMPLES

- Link to the University of Texas' Geographer's Craft Project on - **mapping physical space**
- Link to Carnegie Mellon University to see samples of - **mapping physical space**

- Particularly interesting in these samples is the classic - Napoleon's 1812 Campaign
- Link to Slippery Rock University for further information on - **mapping physical space**

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CONCEPT NAME

- **Mental Mapping: Psychological Space and Distance**

DEFINITION AND EXAMPLES

- Cognitive mapping seeks to understand how people perceive their spatial environment and how those perceptions get translated into actions. The reality of space sometimes gets set aside as people operate on their understanding of reality as it exists in their own mental maps.
- Introductory Human Geography textbooks usually introduce this topic by looking at the classic map - "New Yorker's View of America". Which exaggerates familiar places by enlarging them compared to the diminished size and detail of places less familiar.
- The urban residents of the downtown section of an eastern city can often meet most of their household requirements within a few city blocks and may not travel for work, recreation or housekeeping more than a few blocks or maybe a 20-30 minute journey. Compare this to the rural west dweller where grocery shopping or a movie may be a 4 hour drive.
- Distance is experiential. The psychological distance for a college student between home and college campus often depends on mode of transport: car / bus / bicycle / walking / skateboard / wheelchair.
- You can reflect on the expanding sense of space that accompanies human development. The confined notions of space to a newborn continuously expand through infancy, toddler, and childhood stages until the adolescent shows a grasp of regional and global scales. In western societies ability focus on the global scale is expected of adults.

WEBLINKS: EXPLANATION AND EXAMPLES

- Link to the Mining Company's Geography Guide for more information on -

Mental Mapping

- Link to the National Center for Geographic Information and Analysis on - **Mental Mapping**

- Link to Virginia Tech's example of - **Mental Mapping**

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SPATIAL DISTRIBUTION

A comparison of features by location. To the poet who showed an impressive understanding of the geographic discipline with his stating: "What does one know of England, if only of England one knows?" we could answer the same for -rainforests, seashores, cities, etc.

SPATIAL DISTRIBUTION	
	Pattern
	Density
	Concentration

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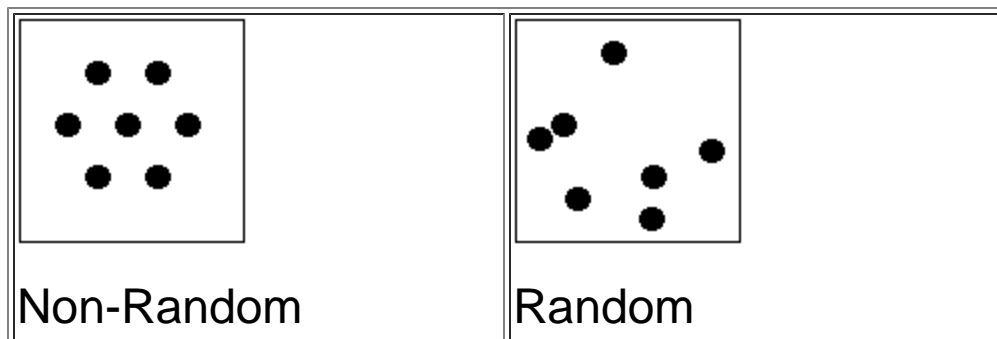
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CONCEPT NAME

- Pattern

DEFINITION AND EXAMPLES

- repetition of a regularity



WEBLINKS: EXPLANATION AND EXAMPLES

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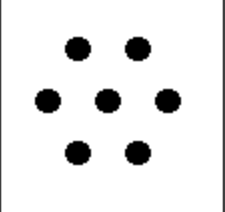
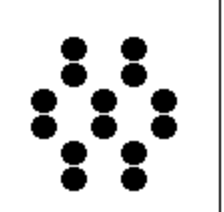
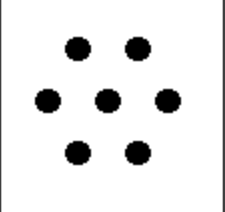
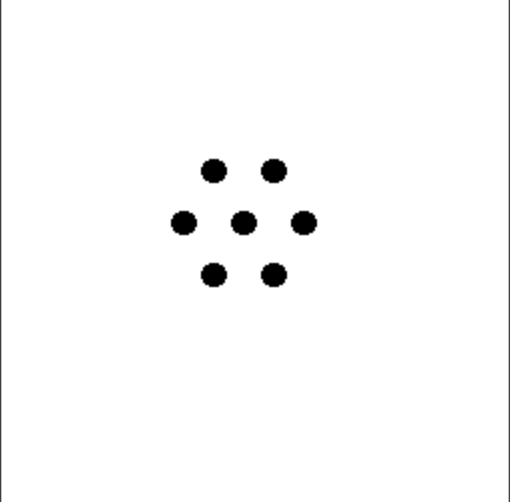
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CONCEPT NAME

- Density

DEFINITION AND EXAMPLES

- number of cases(phenomena) per unit area

	
Lower Density	Higher Density -- more cases
	
Higher Density	

Lower Density -- greater area

WEBLINKS: EXPLANATION AND EXAMPLES

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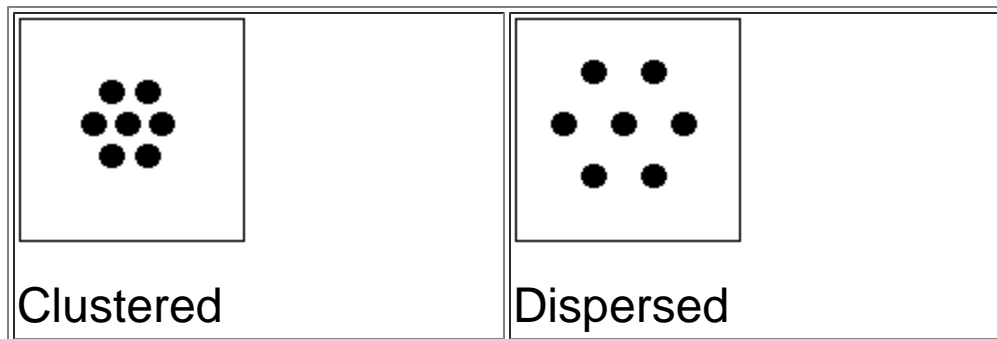
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CONCEPT NAME

- Concentration


DEFINITION AND EXAMPLES



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SPATIAL INTERACTION

- The mobility of things, ideas, and people.
- Can be as varied as:
 - air masses
 - ocean currents
 - concept of multi-party democracy
 - political refugees

SPATIAL INTERACTION	
	Agglomeration
	Accessibility
	Connectivity
	Heartland/Hinterland

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• Agglomeration

DEFINITION AND EXAMPLES

- tendency of like activities to cluster - governed by similar circumstances
- some activities are located in close proximity. Some for mutual benefit, some for parasitic(one-way) relationships.
- world population -four major clusters -East Asia, South Asia, Europe, Eastern North America
- cities are an agglomeration of human activity; political, economic, social, and cultural,
- US population - greater than 50% within 50 miles of a coastline
- shopping centers - anchor stores(major department) & clusters of smaller stores, often off-site clustering of similar merchandizing & services
- technology centers - Wichita Kansas - Boeing, Beech, Raytheon, Lear, Piper
- gambling and entertainment - Las Vegas, Nevada
- computer and biotechnology -Silicon Valley(southern San Francisco Bay area), Route 128 -Boston, etc, etc

WEBLINKS: EXPLANATION AND EXAMPLES

- Link to Toulouse, France to see some work with city **agglomerations**

TEXT REFERENCES



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CONCEPT NAME

Accessibility

DEFINITION AND EXAMPLES

- approachability
- those places that are most accessible have the greatest commercial value due to their ability to attract patronage.
 - i.e. central cities(all roads lead to ...)
 - i.e. 'Edge Cities' regional business centers located at the junction of freeways

WEBLINKS: EXPLANATION AND EXAMPLES

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CONCEPT NAME

- **Connectivity**

DEFINITION AND EXAMPLES

- linking, the degree of possible interaction or relationship
- not only physical connectivity but also in the age of communication, fiber optics and satellite links need to be considered.

WEBLINKS: EXPLANATION AND EXAMPLES

- Link to Alaska Airlines - Route Map
- Link to Canadian Airlines International & partner American Airlines to the the combined North America - Route Map

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CONCEPT NAME

- Heartland/Hinterland


DEFINITION AND EXAMPLES

- a special kind of relationship that stems from dominance of a core area over its periphery.
- the dominance may take the forms: political or economic
- in the US the industrial heartland of the northeast was the 'engine' that dominated the country's economy while the other sections were lesser contributors. The change to a service and technology economy has permitted the ascension of the 'sunbelt' states in economic, population, and political terms.
- in Canada economic and political considerations are dominated by the Toronto to Montreal core over the Eastern, Northern and Western peripheral areas.

WEBLINKS: EXPLANATION AND EXAMPLES

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SPATIAL TRANSITION (Time and Space)

Spatial phenomena change from place to place and places change in character over time

SPATIAL TRANSITION (Time and Space)	
	Spatial Diffusion
	Sequent Occupance



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CONCEPT NAME

- **Spatial Diffusion**

DEFINITION AND EXAMPLES

- changing time **AND** changing places
- transfer or movement of things, ideas, people from place to place
- a main mechanism in the process of cultural change. Technology, for example, is produced through innovation(internal) and spread through diffusion(external)
- processes of diffusion : - the origin in time and place of the feature
- the routes, chronology, and manner of the spread
- any "regionalization" of features
- resultant geographies
- globalization is essentially a process of diffusion, note the labels in your household:

- Korea - computer
- Japan - stereo
- Germany - car
- Brazil - shoes
- India - shirts and blouses

- **Expansion Diffusion**

- Contagious

- does not necessarily have a not a specific pre-existing structure for transmission
- disease contagion is a prime example

the spread of products from a forest fire(particles/gases/heat) dissipate from the source(the fire) throughout the adjacent atmosphere.

- Measurement system - System International (Metric) (meters/grams) has spread from Europe throughout the world except for the US(and a couple small countries) US retains its modification of the British Imperial system of measurement (miles/pounds)

- Hierarchical

- requires a pre-established structure to channel the flow ie 'chain of command'
- International Business hierarchy, National, Regional, Local

- Relocation Diffusion

- Movement of people and things
- Europeans moved to the Americas and brought their culture with them
- Air masses move across the surface acquiring the characteristics of those surfaces
- An advancing low pressure system brings with it conditions to spawn tornadoes

WEBLINKS: EXPLANATION AND EXAMPLES

- Link the Prof. Ward's U of Washington(U of Colorado) to see several good examples of - **Diffusion**

To see to a map on the Spread(**Diffusion**) of Democracy

To see a "Powerpoint" Slideshow on Spatial and Temporal - **Diffusion**

To RUN a "Shockwave" flash animation of Spread(**Diffusion**) of Democracy

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CONCEPT NAME

- **Sequent Occupance**

DEFINITION AND EXAMPLES


- a concept in cultural geography that examines the change in a place using a chronological framework
- changing time **BUT** constant space
- examine Southern California and the sequence of occupying groups
 - Aboriginal Period
 - Spanish Period
 - American Period
 - Internationalization Period
- cities of today have 'evolved' over time, what have been the pressures that have influenced the responses.

WEBLINKS: EXPLANATION AND EXAMPLES

- Link to Prof. Foust's webpage, check out his "Powerpoint" slideshow on - **Sequent Occupance**

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SPATIAL ORGANIZATION

Classification is the first step in science, classification is a means of organization

SPATIAL ORGANIZATION	
	Systems (Themes)
	Regions



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CONCEPT NAME

- Systems(Themes)

DEFINITION AND EXAMPLES

- linkages of interconnected components of a similar type defined by topic not by space
- used to assess causal relationships
- i.e. Physical Geography looks at the system of physical interactions(and physical-human) and contributing subsystems—atmosphere, lithosphere, hydrosphere, and biosphere.
- i.e. Human Geography looks at the system of human interactions(and human-physical) and contributing subsystems—population, economic, political, cultural, urban.

WEBLINKS: EXPLANATION AND EXAMPLES

TEXT REFERENCES

Christofferson	Page 5
Fellman	Page 27



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CONCEPT NAME

- Regions

DEFINITION AND EXAMPLES

- a type of spatial classification
- boundary containing features of like character
- need criteria separating what is included vs what is excluded
 - Physical Regions - Pacific Rim
 - Cultural Regions - Latin America
 - Formal Regions - European Union
 - Functional Regions - North America Free Trade Area(NAFTA)(Mexico, US, Canada)
 - Perceptual Regions - Third World, Sunbelt

WEBLINKS: EXPLANATION AND EXAMPLES

- Link to Prof. Foust's webpage, check out his "Powerpoint" slideshow on - **Regions**

- Link to Geoserve's(Europe) consortium members to see an example of a **Functional Region**

TEXT REFERENCES

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deBlij	Page 4
Fellman	Page 16
Knox	Page 24
Rubenstein	Page 28

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LANDSCAPE

The characteristics of the environment.

LANDSCAPE	
	Natural Landscape
	Cultural Landscape



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CONCEPT NAME

- Natural Landscape

DEFINITION AND EXAMPLES

- the earth's features and processes without the influence of humans
- in addition to its intrinsic value the natural landscape provides the setting for human activity.
- it is only for definition and study purposes that humans are separated out from nature as people are natural too. It is however due to our humanocentric point of view and that we are the ecological dominant that we are defined out.

WEBLINKS: EXPLANATION AND EXAMPLES

TEXT REFERENCES

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deBlij	Page 8
Fellman	Page 12

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CONCEPT NAME

- Cultural Landscape

DEFINITION AND EXAMPLES

- human modification of the natural world.
- the visible imprint of human activity
- built environment

WEBLINKS: EXPLANATION AND EXAMPLES

TEXT REFERENCES

Fellman	Page 12
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