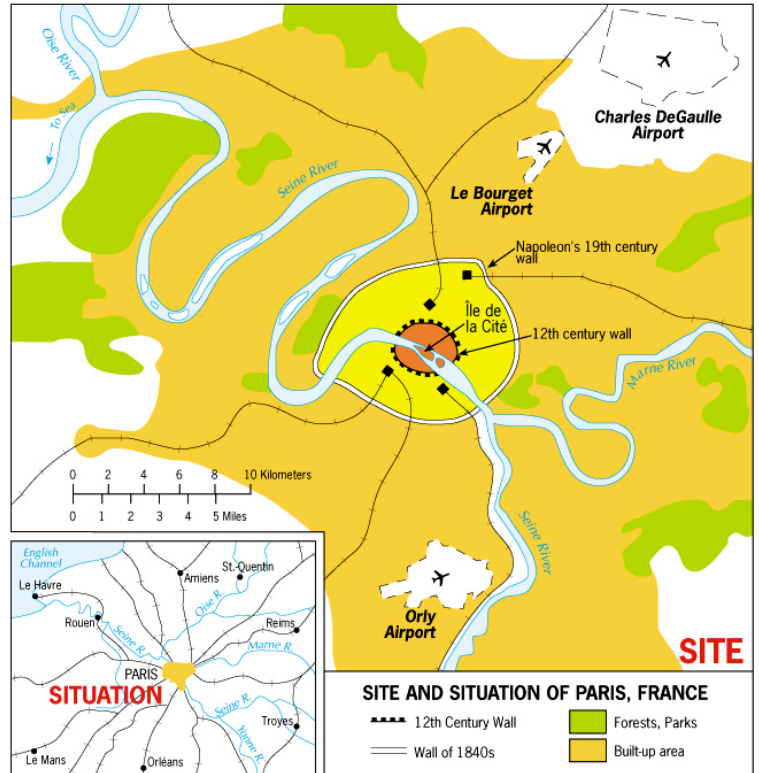# Urban Hierarchies

The ability to identify and understand existing or emerging patterns is one of the most critical skills in intelligent decision-making. There are two kinds of patterns: repeating and growing. Repeating patterns have a sequence that goes and then repeats itself over and over again. Growing patterns have a starting point and then grow by a set interval infinitely. The power of patterns is that they allow us to predict what will come next and they allow us to solve problems that would be very tedious to solve otherwise. Human nature – just as in nature itself – tends to follow certain patterns, since we are all the same species. Combining past experience, intuition, and common sense, the ability to recognize patterns gives us the ability to predict what will happen next with some degree of accuracy.

Urban Functions

Cities tend to grow or shrink in terms of importance and population due to two essential factors – site and situation. **Site**, in urban terms, refers to the physical qualities of a place, or its absolute location. A city's location is often chosen for purposes of trade, defense, or resources. For example, Paris, France was first established on an island on the Seine River. **Situation** has to do with the place's relationship relative to other things such as travel routes, farmlands, manufacturing complexes, towns, or cities - its near & distant surroundings. This is subject to change over time, just as Paris grew as it became an increasingly important location in terms of trade with other regions.

It is important to note that every town and city has an economic base. For example, loggers, miners, or workers in a manufacturing plant are in the city's **basic sector**; their work produces goods for export and generates an inflow of money. The profits from this work depend largely upon non-local factors. On the other hand, the **nonbasic**

SITE AND SITUATION OF PARIS, FRANCE
- ▪▪▪▪ 12th Century Wall
- ═══ Wall of 1840s
- Forests, Parks
- Built-up area

sector depends largely upon local business conditions or is responsible for the functioning of the city itself (e.g., teachers, street cleaners, office clerks, etc.).

According to the **economic base theory**, the means of strengthening and growing the local economy is to develop and enhance the *basic* sector. The ratio of basic to nonbasic workers gives an impression of the city's **economic base** (or **employment structure**). The economic base of a city will tend to change as it grows, this is known as the **multiplier effect**. To further explain, a new basic industry will create jobs in the non-basic sector, directly or indirectly. New workers demand goods and services for their wants and needs. Additionally, those who perform those services themselves demand even more services (e.g., a grocery clerk must also buy groceries). As a result, the multiplier effect increases as a city grows, as shown in the generalized representation in the graph. But the multiplier effect also shows us that larger centers are more self-contained (possessing more of the basic needs and the amenities that people want).

Although it is becoming increasingly uncommon, some cities are dominated by one particular activity. This **functional specialization** was more evident in the past – Detroit's automobiles, Pittsburgh's steel, and Houston's aerospace industry were but a few examples. Today these cities have grown, and as such have become much more diversified. Some functional specialization can still be seen today – Orlando's theme parks and vacation spots, and Las Vegas' casinos are two examples.
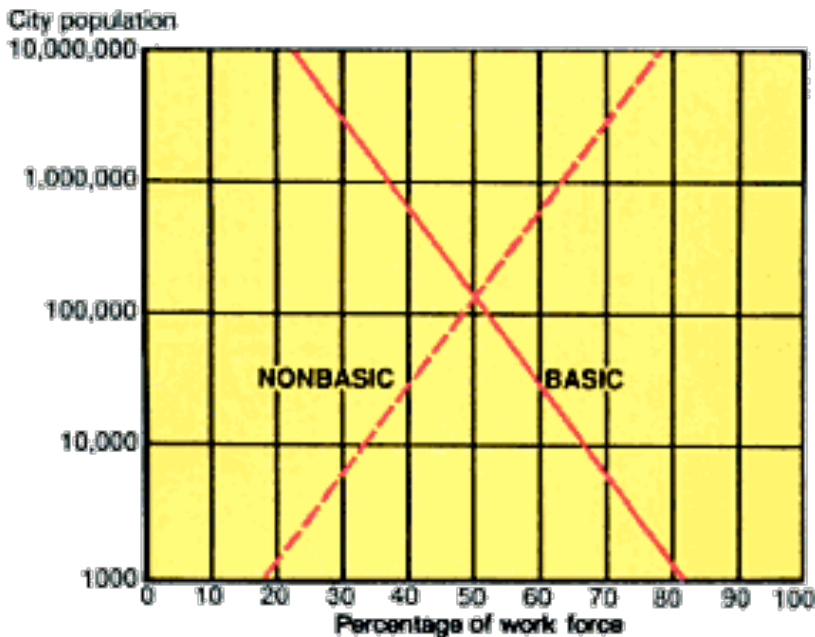
City Growth and the Gravity Model

Cities may grow or shrink due to industrial growth, and in fact, may be the single greatest factor related to the size of cities. However, cities may also grow for other reasons. Many cities today are close to **resource nodes**, such as Dickinson ND, one of the fastest growing in the entire United States as of 2014 – due to the boom in oil and natural gas production. As different resources are discovered, or become more valuable, people flock to these locations for opportunity. This explains the gold rush into California in the 1840s, or concentration of Western European cities along coal deposits during the Industrial Revolution.

Then, there's the story of Dulles, Virginia – which is technically not a true city, but an unincorporated area (without its own municipal government). Commercial development can lead to urban growth around **transport nodes** such as seaports, rail depots, or airports, such as what happened around Dulles International. The ease of transportation around these hubs attracts people and businesses alike. While these predictions may seem fairly obvious, there are ways to more accurately measure the **centrality** – or pull of a city.

According to the **gravity model**, any two locations attract one another with a force that is proportional to the product of their importance, and inversely proportional to the square of the distance between them. Therefore, the centrality of a city is based on the idea that as the importance of one or both of the location increases, there will also be an increase in movement between them. The farther apart the two locations are, however, the movement between them will be less. This phenomenon is known as **distance decay**.

> *"Everything is related to everything else, but near things are more related than distant things."*
>
> Waldo Tobler's First Law of Geography

Primate Cities and the Rank-Size Rule

In many instances, cities continue to grow until they become remarkably dominant in a country or region. The 'law of the **primate city'** was first proposed by Mark Jefferson in 1939. He defined a primate city as being "at least twice as large as the next largest city and more than twice as significant." It is the leading city in its country or region, and disproportionately larger than any others in the urban hierarchy. A primate city is number one in its country in most aspects, such as politics, economy, culture, education, etc.

However, Gunnar Myrdal in 1957 discussed the **backwash effect**. He argued that economic growth in one area adversely affects the prosperity of another. Wealth and labor move from poorer, peripheral areas to more central regions of economic growth and the industrial production

of wealthy regions may well undercut the industrial output of the poorer regions. This draining of wealth and labor together with industrial decline in the **economic backwaters,** creating a polarization effect.

For example, in northern Argentina lies the dominant primate city of Buenos Aires. As the capital of Argentina, the government tends to favor that site for development. More infrastructure and money poured into the site attracts even more workers to the location, as well as foreign investment. This may lead to the underdevelopment of other cities in the region in terms of infrastructure, investment, and human capital (as people continually migrate to the primate city). As you can see in the map, the roads primary lead to Buenos Aires, which is the key location in the area for imports and exports.

Related to the primate city concept it the theoretical notion of the **rank-size rule**, established by George Zipf in 1949. This rule holds that in a model urban hierarchy, the population of a town or city will be inversely proportional to its rank in the urban hierarchy. The formulaic definition for the rank-size rule is as follows:

The Nth largest city is 1/n the size of the country's largest city.

For example, if the largest city has 12 million people, the second city will have around 6 million (½ the population of the largest city); the third will have 4 million (⅓ the population of the largest city); the fourth city 3 million; and so on. The rank-size rule does not apply in all countries, especially those with dominant primate cities (e.g., France, Mexico). However, it does somewhat apply in several countries with complex economies, such as Canada, Australia, Russia, and Germany.

In contrast to northern Argentina, Germany doesn't have a primate
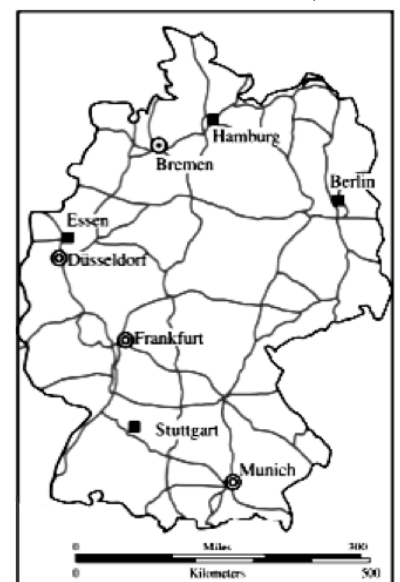
city. Germany is a federal state, divided into sixteen Länder (or individual States) ever since its reunification after World War II. Each region has developed on its own while also being supported by the federal government. As a result, no single region has become too centralized as compared with the others. However, West Germany has fared much better in large part due to the constraints East Germany suffered under decades of communist planning, stifling its development. Nonetheless, Germany has the benefit of vast resources and a favorable relative location within the wealthy European Union, propelling it to being one of the most developed countries in the world. Additionally, the road network is a result and cause for the more equal distribution of jobs and wealth across Germany.

In another example, The United States displays a **binary distribution** of the rank-size rule. When a country has two large cities of similar dominance in separate regional areas; the rank-size rule may apply regionally. The eastern US is anchored by the largest city, New York, followed by Chicago, Philadelphia, and Boston. The largest city in the west, Los Angeles, is followed by San Francisco, Phoenix, and Seattle. The chart below illustrates that the rank-size rule does generally apply in a regional sense.
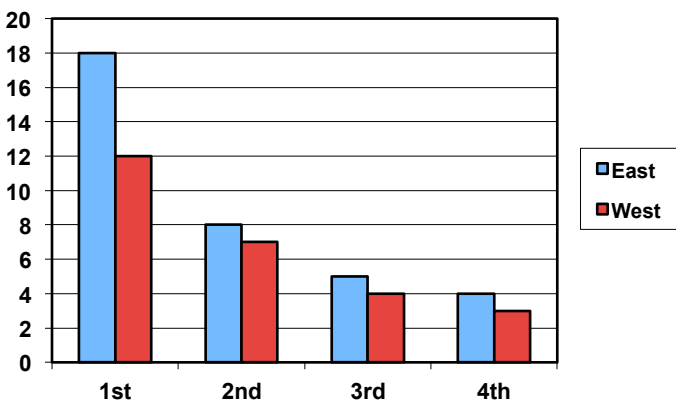
Central Place Theory

How do service areas relate to each other? Do they overlap? Do towns of approximately the same size lie about the same distance away from each other? Every urban center has a certain economic reach that can be used as a measure of its centrality.

In 1933, Walter Christaller, a German, laid the groundwork for **central place theory**. He attempted to develop a model that would show how and where central places (hamlets, villages, towns, cities,…) would be functionally and spatially distributed. In his model, the ideal region would have flat terrain with no physical barriers. Soil fertility, population distribution, purchasing power, and transportation networks would all be uniform. Finally, he assumed that a constant maximum distance or range of sale of any good or service produced in a central place would prevail in all directions from that urban center. Christaller's idea was to compare his model to real world situations and try to explain any variations and exceptions. He defined **central goods and services** as those provided only at a central place (e.g., bowling alley, professional sports team,…). The **range of sale** was the distance people would be willing to travel to acquire the goods or services. The limit would lie halfway between one central place and the next where the same product was sold at the same price (all things being equal, you wouldn't travel 10 miles to a movie theater if one was 5 miles away). The **threshold** is the minimum market area needed to bring a firm or city selling goods and services into existence, and to keep it in business.

In Christaller's urban model, each central place has a surrounding **complementary region**, an exclusive hinterland (or market area) within which the town has a monopoly on the sale of certain goods or services because it alone can provide these within the range of sale. If all his assumptions were in effect, such complementary regions would be circular, but this would create some significant problems. The issue is that either the circles adjoin and leave unserved areas (A), or they overlap; in the latter situation (B) the central place no longer has a monopoly.
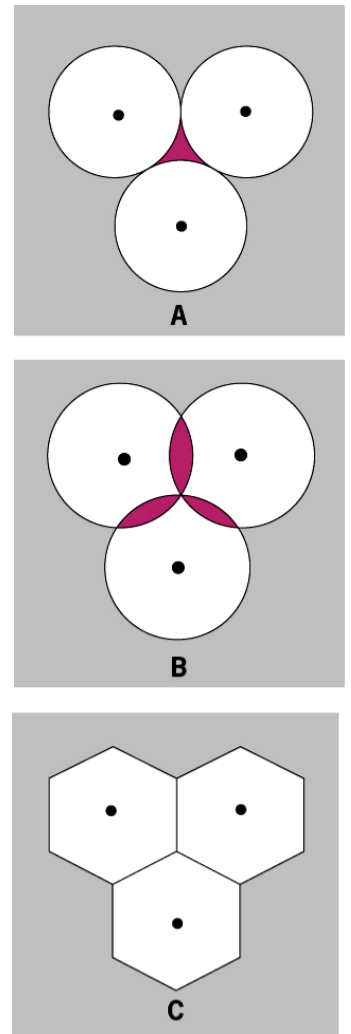
These two problems are resolved by a model consisting of perfectly fitted **hexagonal regions** (C). If, for example, the hexagonal complementary region was focused on a hamlet (where the fewest goods and services are available), that hamlet and its region form a complementary region of a village. And that village and its complementary region would be part of a town's complementary region, and so on. Thus, a **nesting pattern** is revealed (region-within-region); each larger region is centered on a higher-order urban place. The image below displays Christaller's interlocking model of a hierarchy of settlements and their service areas (H=hamlet; V=village; T=town; C=city).
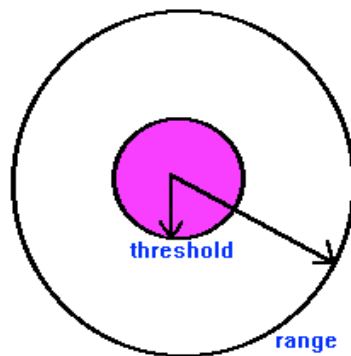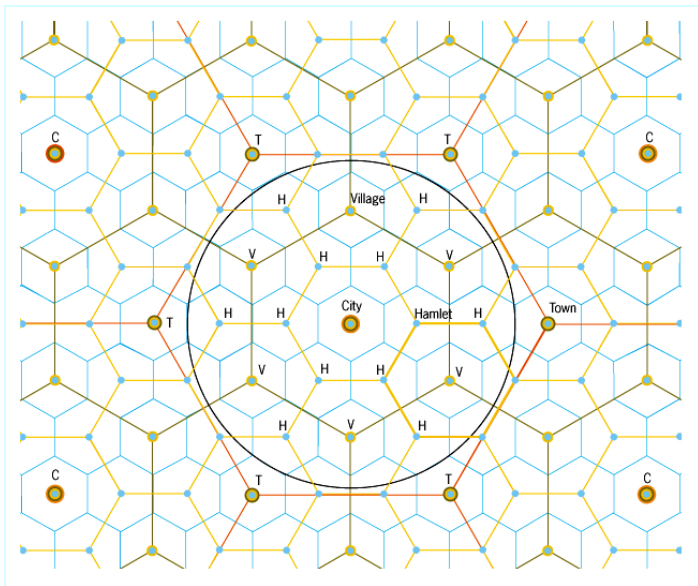
There are at least **four major generalizations** we can make using central place theory. First, the greater the size of a central place, the fewer in number they are in an urban hierarchy. The ranks of urban places do in fact form an orderly hierarchy of central places in spatial balance. Second, the greater the size of the central places, the longer the distance between them. Third, the greater the size of central places, the larger the number and range of functions will exist within them. A small village may only have a small store, or a few farms, whereas a large city will have many places to purchase goods, to visit, to be educated, or be healed, and so on. Finally, the greater the size of central places, the larger the number of higher-order services. It comes down to human nature, people are not willing to travel farther than they need for a tank of gas, or a loaf of bread, but willing to go much farther to go to an arena, university, aquarium, zoo, museum, etc.

Like **von Thünen**, whose model was based on a series of assumptions, Christaller knew that conditions would be different in the real world. His ideas may be applied to the real world, but keep in mind – it is still a model, not reality. Studies in the U.S. Midwest suggested that while the square layout of the township-and-range system imposed a different kind of regularity on the landscape (square, not hexagonal), the spatial forces at work there tended to confirm Christaller's theory. Relatively flat lands in China display some similarities to the central place model.

Of course, as with any model, it has its issues. If the physical landscape is not flat, then the neat nesting hexagonal patterns rarely form. Competition from other places, or changes in the demand for a good or service in a central place may limit its centrality. Improvements in transport technology increase mobility, and causes more overlapping of complementary regions. Furthermore, the theory holds decently well for agricultural areas, but not as well for industrial and post-industrial areas. The diversified nature of a more complex economy usually prevents a single area from having a monopoly on most goods or services. Finally, the theory does not incorporate the temporal aspect in the development of central places over time. There is no aspect of central place theory that enables it to accurately predict how an urban hierarchy will develop into the future.
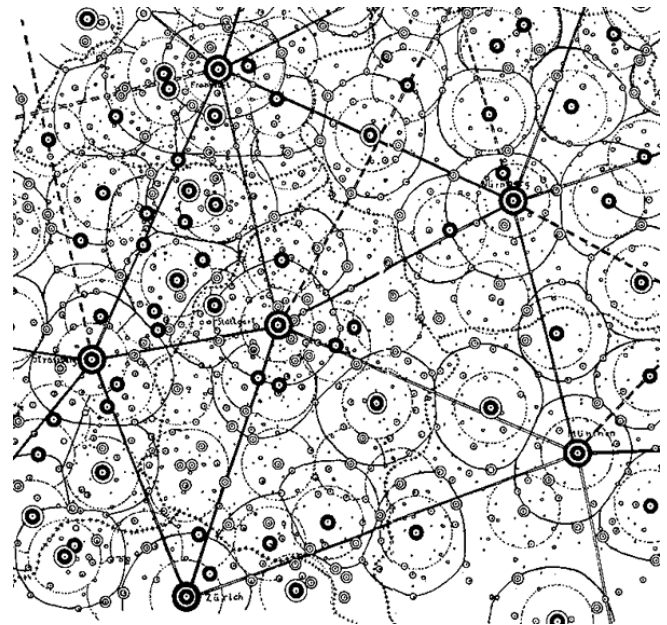
Southern Germany in 1933

Keep in mind, when central place theory was first formulated in the 1930s, the world was a simpler - and much less populated - place than it is today. Take, for example, the so-called Sunbelt phenomenon since the 1960s – the movement of millions of Americans from northern and northeastern States to the South and Southwest. Some of this was through involuntary, internal migration made possible by social security and retirement money. It has also resulted from governmental economic and social policies that favor "Sunbelt" cities through federal spending on military, aerospace, and research facilities. In addition, millions of Middle and South American migrants moved northward – into the same urban centers already growing for domestic reasons. The overall effect of this was to create a changed **urban hierarchy** in the Sunbelt region. Many cities – Miami, Atlanta, Dallas, and Phoenix – have become major central places in the United States.

Nonetheless, Christaller's model confirmed that the general pattern we see on the map is not an accident but a product of specific forces that tend to create regular rank-size patterns. Central place theory, at least in some part, helps us to understand and predict the number, size, and locations of places in an urban setting.