

# Architecture and Geometry

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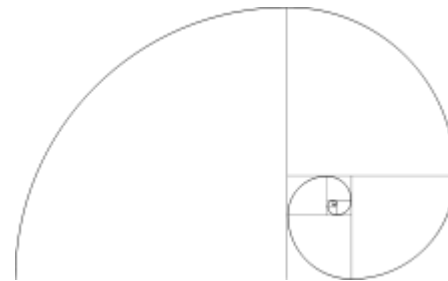
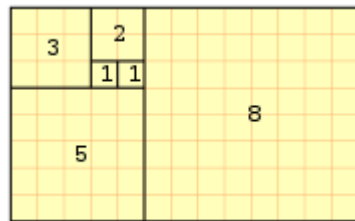
**December, 2012**

# Inspiration in Nature

- Logarithmic Spiral



- Fibonacci Spiral



- Proportion



# Nature Examples



# Logarithmic Spiral



# Regular polygons (honeycombs), etc.

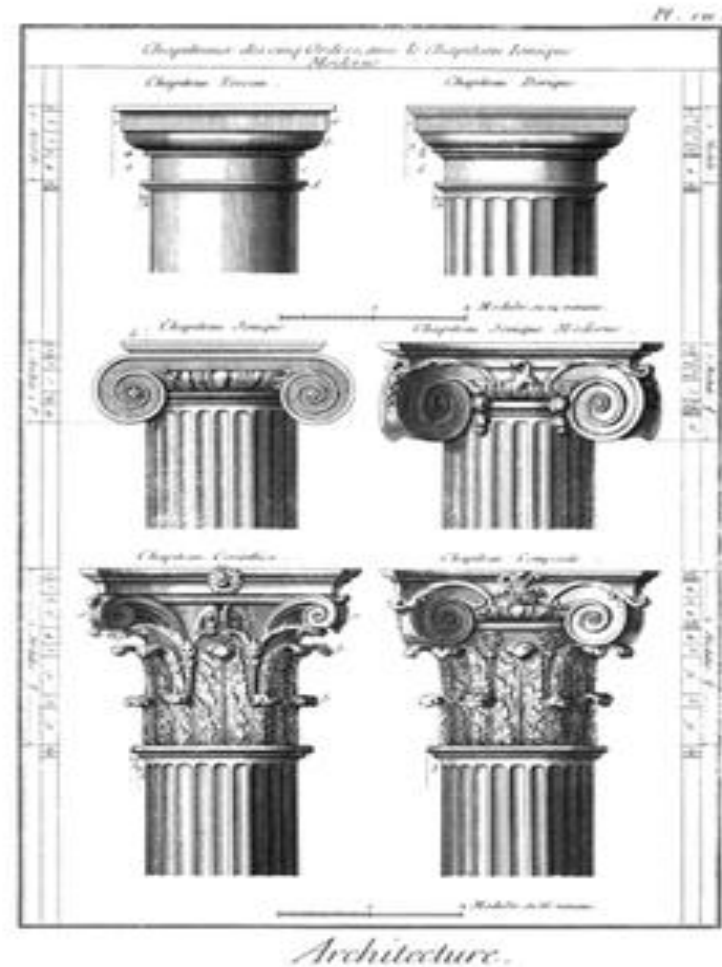


# Regular polygons



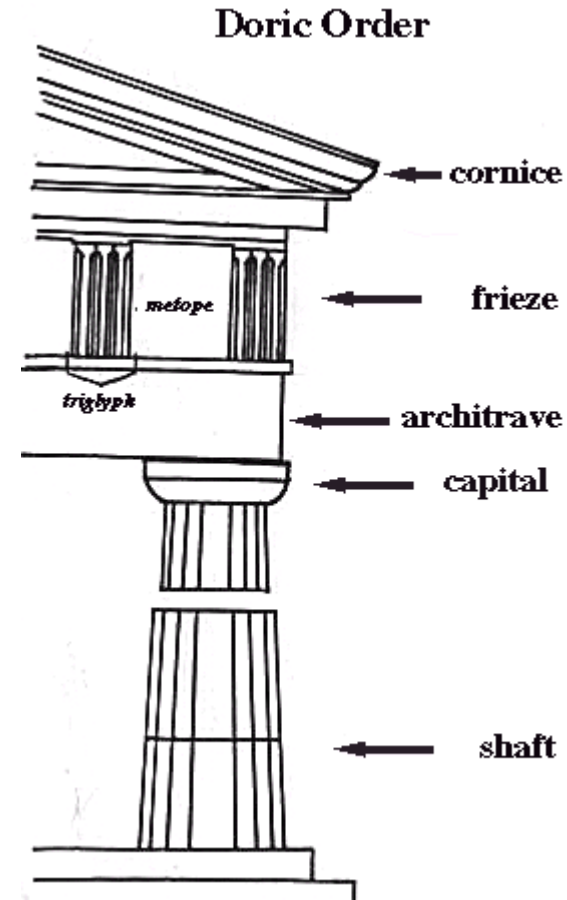
# Greek Order of Architecture

- Doric Order
- Ionic Order
- Corinthian Order



# Doric Order

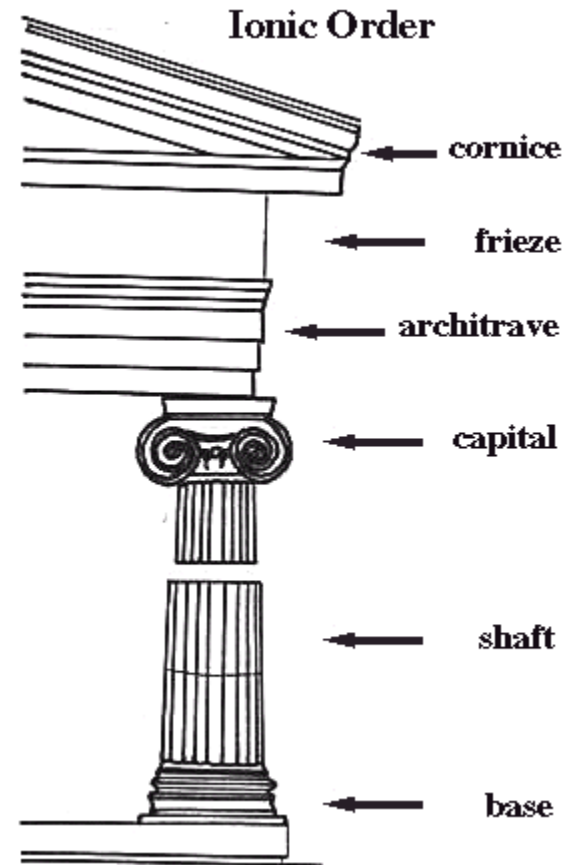
- **DESCRIPTION:** Of the three columns found in Greece, Doric columns are the simplest. They have a **capital** (the top, or crown) made of a circle topped by a square. The **shaft** (the tall part of the column) is plain and has 20 sides. There is no **base** in the Doric order. The Doric order is very plain, but powerful-looking in its design. Doric, like most Greek styles, works well horizontally on buildings, that's why it was so good with the long rectangular buildings made by the Greeks.
- The area above the column, called the **frieze** [pronounced "freeze"], had simple patterns. The columns are the metopes and triglyphs. The **metope** [pronounced "met-o-pee"] is a plain, smooth stone section between triglyphs. Sometimes the metopes had statues of heroes or gods on them.
- The **triglyphs** are a pattern of 3 vertical lines between the metopes.
- There are many examples of ancient Doric buildings. Perhaps the most famous one is the **Parthenon** in Athens, which is probably the most famous and most studied building on Earth. Buildings built even now borrow some parts of the Doric order.





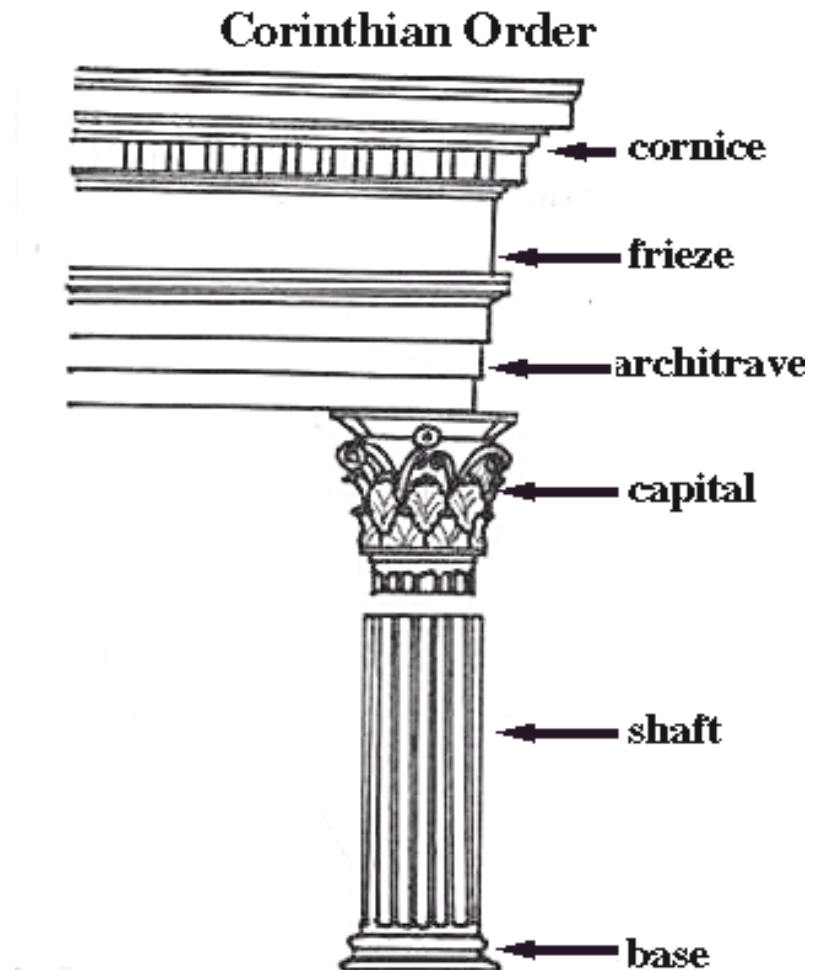
# Ionic Order

- **DESCRIPTION:** Ionic *shafts* were taller than Doric ones. This makes the columns look slender. They also had *flutes*, which are lines carved into them from top to bottom.
- The shafts also had a special characteristic: *entasis*, which is a little bulge in the columns make the columns look straight, even at a distance [because since you would see the building from eye level, the shafts would appear to get narrower as they rise, so this bulge makes up for that - so it looks straight to your eye but it really isn't !] .
- The *frieze* is plain. The *bases* were large and looked like a set of stacked rings. Ionic *capitals* consist of a scrolls above the shaft. The Ionic style is a little more decorative than the Doric.



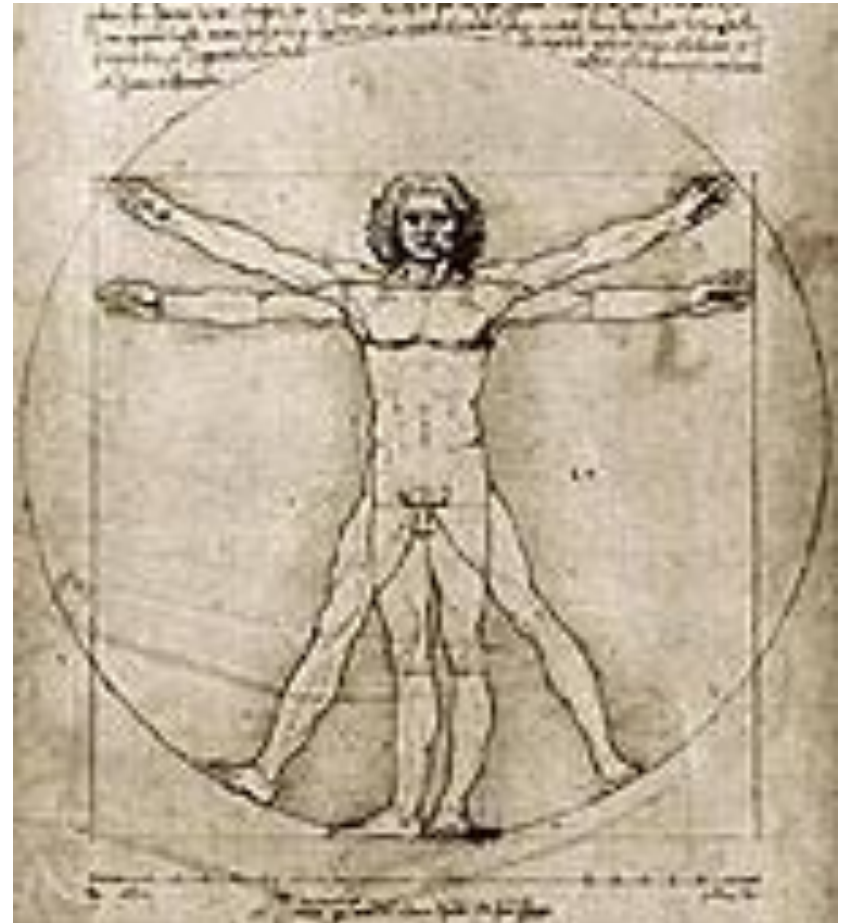
# Corinthian Order

- **DESCRIPTION:** The Corinthian order is the most decorative and is usually the one most modern people like best. Corinthian also uses *entasis* to make the shafts look straight.
- The Corinthian *capitals* have flowers and leaves below a small scroll.
- The *shaft* has flutes and the base is like the Ionian. Unlike the Doric and Ionian *cornices*, which are at a slant, the Corinthian roofs are flat.



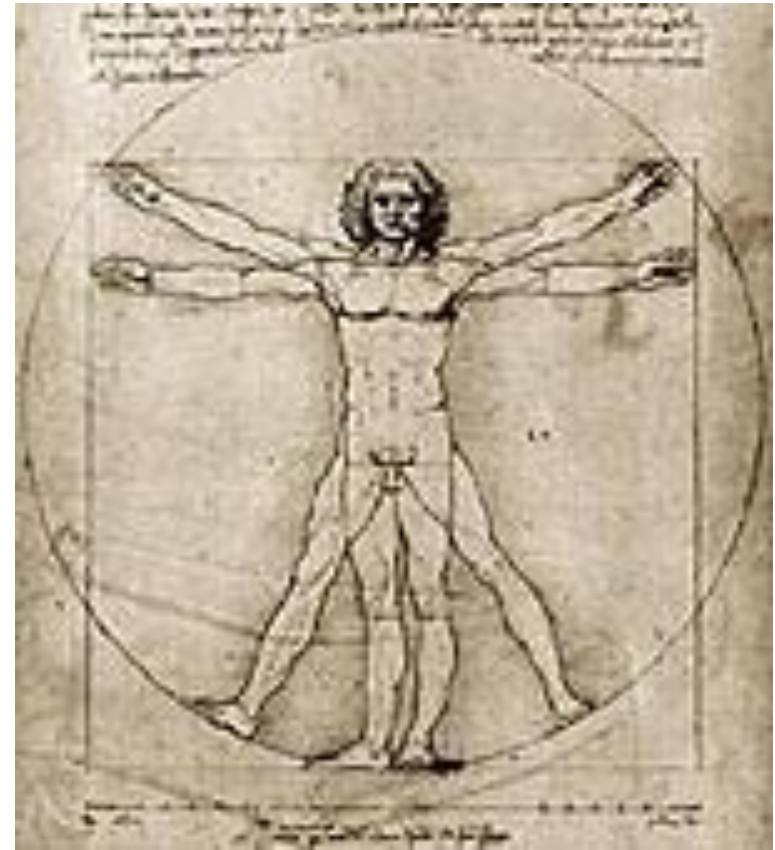
# Vitruvius

- Architecture begins with geometry. Since earliest times, architects have relied on mathematical principles. The ancient Roman architect Marcus Vitruvius believed that builders should always use precise ratios when constructing temples. "For without symmetry and proportion no temple can have a regular plan," Vitruvius wrote in his famous treatise *De Architectura, or Ten Books on Architecture*.



# Proportion of Human Body

- The proportion Vitruvius recommended was modeled after the human body. He observed that all human beings are shaped according to a ratio that is astonishingly precise and uniform.
- For example, Vitruvius found that the human face equals one tenth of the total body height. The foot equals one sixth of the total body height. And so on.



# Divine ratio

- Scientists and philosophers later discovered that the same ratio Vitruvius saw in the human body – 1 to PHI (1.618) – exists in every part of nature, from swimming fish to swirling planets. This ***divine ratio***, or ***divine proportion***, has been called the building block of all life.



# 1100-1450: Gothic Architecture

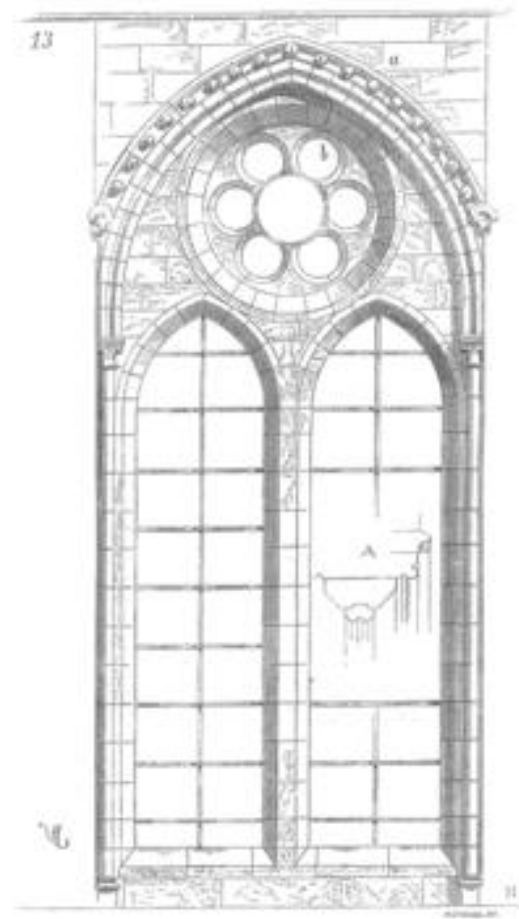
- Early in the 12th century, new ways of building meant that cathedrals and other large buildings could reach soaring heights.

## How Gothic Architecture Began

Gothic architecture began mainly in France where builders began to adapt the earlier Romanesque style.

- Builders were also influenced by the pointed arches and elaborate stonework of Moorish architecture in Spain.
- One of the earliest Gothic buildings was the ambulatory of the **abbey of St. Denis in France, built between 1140 and 1144.** Originally, Gothic architecture was known as the *French Style*.
- During the Renaissance, after the French Style had fallen out of fashion, artisans mocked it. They coined the word *Gothic* to suggest that French Style buildings were the crude work of German (*Goth*) barbarians. Although the label wasn't accurate, the name Gothic remained.

# Chartres

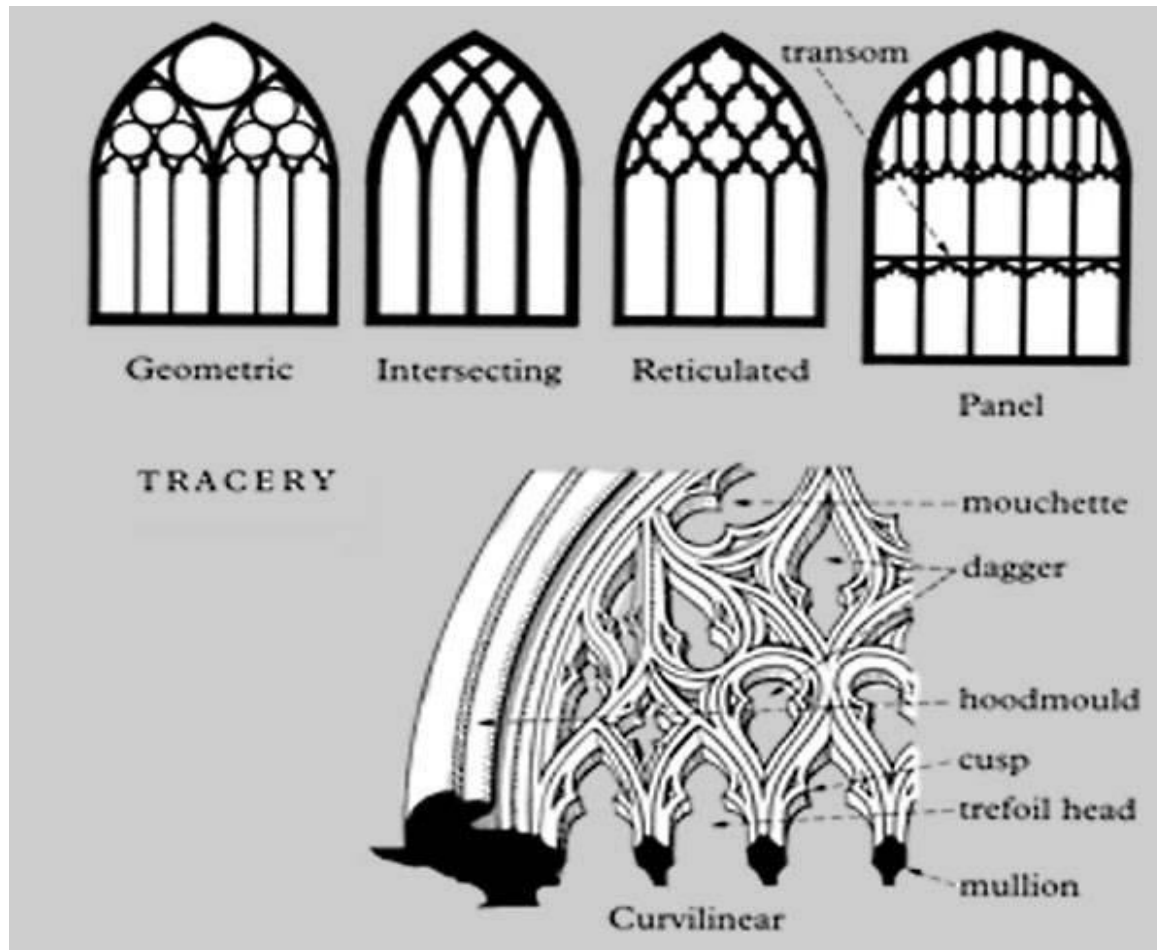


# Gothic architecture has many of these features:

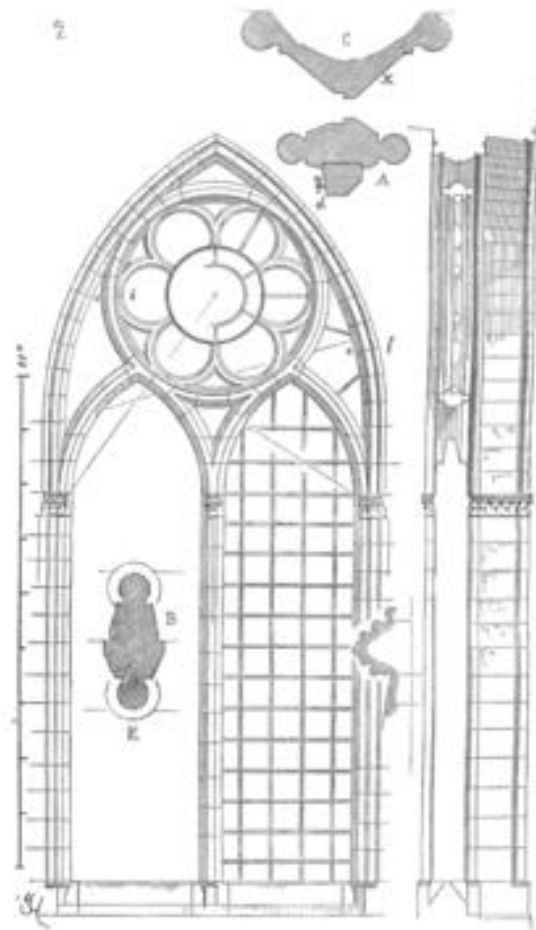
- **Pointed Arches** - Gothic builders found that pointed arches could support more weight than perpendicular walls. With pointed arches supporting the roof, walls could be thinner.
- **Ribbed Vaulting** - Instead of solid walls, builders used a series of columns that branched up into arches. With fewer solid walls, buildings appeared lighter and more delicate.
- **Flying Buttresses** - Free-standing brick and stone arches helped support exterior walls, allowing them to reach greater heights.
- **Stained Glass Windows** - Since the walls were no longer the only supports, Gothic buildings could include large areas of glass.
- **Elaborate Sculptures** - Gargoyles and other sculptures had both practical and decorative functions.



# Construction of Gothic Windows



# Reims



# Czech Gothic



# Different Gothic Styles



- Other late Gothic styles include the British **Perpendicular style** and the French and Spanish **Flamboyant style**.



Lincoln



Chartres