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# The Development of Stained Glass in Gothic Cathedrals

Elizabeth (Aislin) Reynolds

*Johnson County Community College*, ereynol8@stumail.jccc.edu

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# The Development of Stained Glass in Gothic Cathedrals

## **Abstract**

Stained glass is arguably one of the most important aspects of Gothic cathedrals. As its popularity rose, mainly during the mid-12<sup>th</sup> century, the increased presence of stained glass presented major changes to the way the general populace was learning about religion. The windows became illuminated visual sermons of biblical stories, which may have had an even greater impact than the spoken word of the priest. This paper focused primarily on the stained glass windows and architectural styles employed in five gothic buildings in France, each having their own unique and notable attributes pertaining to the development of stained glass windows. By looking at the architectural advancements shown in these structures built during the gothic time frame, we are able to see the impact of the widespread desire for increased height and light within these types of buildings on the gothic cathedral.

## **Cover Page Footnote**

Honors mentor: Dr. Allison Smith, Associate Professor and Chair, Art History

Stained glass is arguably one of the most important aspects of Gothic cathedrals. As its popularity rose, mainly during the mid-12<sup>th</sup> century, the increased presence of stained glass presented major changes to the way the general populace was learning about religion. The windows became illuminated visual sermons of biblical stories, which may have had an even greater impact than the spoken word of the priest. In this research paper, I will be primarily focusing on the stained glass windows and architectural styles employed in five gothic buildings in France, each having their own unique and notable attributes pertaining to the development of stained glass windows. By looking at the architectural advancements shown in these structures built during the gothic time frame, we are able to see the impact that the widespread desire for increased height and light within these types of buildings had on the gothic cathedral.

The term ‘stained glass’ applies to colored glass made with metallic oxides as well as glass on which colors have been painted and then fused in a kiln. To produce a stained glass window, an artisan would first make sketches or “cartoons” of the finished window by drawing out a life-sized blueprint of the window onto a board. Following the creation of the blueprint, the glass is produced by combining sand and potash at temperatures of nearly 3000 degrees. While the glass is still in a molten state, the artisan colors it by adding small amounts of metallic oxide powders. Copper oxides were used to produce shades of green or blue-green; cobalt would create a deep blue, and gold could be used to produce a wine-red or violet colored glass. The then-colored molten glass would be blown and flattened into sheets. After the sheets of glass had cooled, the artisan would lay the pieces onto the cartoon and crack the glass into rough approximations of the sizes needed with a hot iron. These rough edges would then be refined by a process called grozing, in which an iron tool was used to carefully chip away the excess glass until the precise shape needed for the composition was produced. Depending on the content of

the window, the artist would sometimes be required to paint details onto the glass with a dark-colored paint made from iron filings and ground glass suspended in a liquid binder, typically either wine or urine (Stokstad and Cothren 2011, 497). This would block light and help to delineate the features of any figures in the design. At approximately the beginning of the 14<sup>th</sup> century artists began using a type of paint called silver stain which was made from silver nitrate. This yielded a yellow effect that could vary in color from pale lemon to deep orange or gold, depending on the thickness of the paint and the duration of its firing. Silver stain was often useful for turning blue glass to green in order to create an image of grass on the window. After being painted, the finished panels of glass would be fitted into H-shaped strips of lead called came. The lines produced by the lead became an integral part of the window's overall design and aided in keeping the colors from blending together when seen from a distance. The came were then soldered together into a secure panel. When the panel was completed, putty would be inserted between the glass and the came for waterproofing. Finally, multiple panels were placed into an iron frame called an armature, creating the finished window which was then ready to be placed into the wall of a cathedral (Stokstad and Cothren 2011, 497). This process remained almost completely unchanged for several centuries, and could take anywhere from a few weeks to many months to complete depending on the size and complexity of the window.

The two most common styles of stained glass windows made for gothic cathedrals were the tall, spear-shaped lancet windows and circular rose windows. The term rose window was coined around the 17<sup>th</sup> century because of the way the windows were constructed in a circular shape with layered radiating panels giving them an appearance similar to that of an open rose (see fig. 2). Before these windows were given this title, they were referred to as wheel windows, which were described as circular windows of panels separated by spokes of tracery radiating

from a central oculus (see fig. 3). The main difference between the two terms is that a rose window typically has a more complex design than that of a wheel window.

The use of stained glass windows gained popularity during the mid-12<sup>th</sup> century. Abbot Suger of Saint Denis has been called the “Father of stained glass” as it was he who first conceptualized the use of stained glass windows to create a ‘heavenly light’ which was seen as the presence of God in the church. Suger oversaw the construction of the Abbey Church of Saint-Denis and, while trying to conceive a completely new church design, found inspiration in multiple texts he read by a follower of St. Paul named Dionysius (the Greek form of Denis), who considered radiant light to be a physical manifestation of God himself. Suger believed that Dionysius was in fact the patron saint of Saint-Denis, so he adapted the concept of divine light into his construction plans and designed the new cathedral around the use of stained glass windows. The Abbey Church of Saint Denis became the prototype for this new type of architecture based on light, openness, and increasingly taller spaces which later developed even further into what is known as the Rayonnant style (Stokstad and Cothren 2011, 494-495). Besides being thought of as divine light, the windows, along with gothic sculpture, have been referred to as a part of the “Poor man’s Bible” based on the fact that another purpose of the windows was to teach Biblical stories to those who were illiterate, which often compromised the vast majority of the citizenry.

A common biblical story that appeared in medieval windows was the “Tree of Jesse”, which was a sort of genealogy or family tree symbolizing the ancestry of Christ. Stained glass windows depicting the Tree of Jesse can be seen at Sainte-Chapelle, Chartres Cathedral, and Notre Dame Cathedral, among other places. In the book of Isaiah a “shoot” coming from the stump of Jesse is described, sprouting a branch that will grow from his roots. The “root of Jesse”

to which it refers is the Davidic monarchy of the eschatological age, and therefore is describing the lineage of kings beginning with Jesse who was the father of King David, proceeding through King Solomon (son of David), and eventually up to the Virgin Mary who usually is portrayed directly beneath the figure of Jesus, or depicted with him as virgin and child at the top of the tree. The oldest Jesse Tree window is at Chartres Cathedral (see fig. 1) where Jesse is depicted reclining at the bottom of the image with the trunk of a tree coming from his side and leading up to Christ who is larger than the other figures, and seated at the top with seven doves around him, which represent the seven gifts of the Holy Spirit. There are also seven prophets bearing scrolls standing along each side of the tree representing the prophets who foretold the coming of Christ (Sacred-Destinations, Chartres Jesse Window). This window also shows the use of the symbolic and holy number seven and multiples, which seems to be a commonly occurring component in the design of stained glass windows.

The idea of bringing additional light into the church also led to many other architectural advancements within the gothic cathedral. One of the most important advancements was the development and use of the flying buttress, which served as an arched exterior support that could transfer the excess weight of a building outward to where it would be supported by an attached buttress rising from the ground. This allowed an increase in window size as well as more wall space to be occupied by windows. One of the best examples of the use of the flying buttress is the Cathedral of Notre Dame de Paris (“Our Lady of Paris”), which is located on a small island on the River Seine in Paris. At least four different architects contributed to the building of Notre Dame cathedral, with construction beginning in 1163, and continuing until 1345.

Notre Dame was the first urban gothic cathedral to use a true flying buttress, although the original plan for the cathedral did not include flying buttresses around the choir and nave at all.

However, as the thin walls were built to greater heights -- the cathedral was 226 feet tall when completed -- stress fractures began to form as the walls pushed outward in response to the increased weight. Because of this, construction of the flying buttresses was required (Princeton). Following this lesson, the buttress became a common structural element of later cathedrals that would prove useful to the ever-present goal of increasing the size and amount of stained glass windows in cathedrals.

Another feature of the stained glass of Notre Dame is that it shows the heavy influence of naturalism unlike that of the earlier Romanesque style of architecture, which was less focused on the accurate portrayal of details. The south rose window of Notre Dame is one of the largest rose windows in the world, with a diameter of approximately 43 feet (see fig. 4). The window is themed around the Old Testament, and composed of 84 panes of glass divided into four circles that initially radiated outwards from a central medallion of Christ. Unfortunately the original central medallion had disappeared while the window was in ruin, and was later replaced by the coat of arms of the archbishop of Paris who restored the window. The sixteen lancet windows below the rose depict sixteen prophets and again we see that another symbolic number, in this case four, and multiples twelve and twenty-four are an integral part of the complex design of this window.

Techniques used at Notre Dame were developed even further in the building of Chartres Cathedral, which began in 1194 and was completed around 1260. Chartres is a brilliant example of the development of western architecture during the gothic age, as it employed all of the new structural elements of gothic architecture in harmony with the previously developed styles including the pointed arch and rib and panel vaults, as well as the flying buttress. The height of the finished cathedral reached 371 feet tall, and it is also known for having the largest collection

of medieval stained glass in the world, containing 176 mostly original windows, as well as having a wonderfully preserved labyrinth. Within the collection, there are three irreplaceable stained glass windows from the 12th century, each with the deep cobalt blue color that has been termed as Chartres blue, of which the secret formula has not yet been discovered. The labyrinth's path is 261 meters (approximately 856 feet) long and has been thought to represent a symbolic road where man meets God. The pilgrims who came to Chartres and participated in the celebrations of the Virgin Mary would walk along it on their knees (French Moments).

One of the most famous stained glass windows at Chartres is the rose window of the western façade (see fig. 2). This window portrays the scene of the final judgment, with Christ in the center displaying his wounds, surrounded by the Four Evangelists and angels. The Twelve Apostles are on the left and right, while above and below are scenes of the resurrection, the weighing of souls by the Archangel Michael, the redeemed being led to heaven by an angel, and the damned being led to hell by a demon (Sacred-Destinations, Chartres Rose Window). It seems to be a common theme in many gothic cathedrals that the windows, as well as the sculpture, of the western façade tend to depict scenes of the final judgment, while the architecture of the eastern façade shows images of the Virgin Mary, or the Virgin and Child enthroned. The theme of the windows is most likely structured this way symbolically, based on the fact that the sun rises in the east and sets in the west, as a way to relate to the beginning and the end.

Amiens Cathedral, built between 1226 and 1270, and Reims Cathedral, constructed between 1211 and 1516, both have very few similarities to Chartres. Amiens and Reims both had labyrinths constructed similar to the one at Chartres. Unfortunately, the labyrinth at Reims

was viewed by many as a symbol of superstition and removed in 1779, its details only known from 18<sup>th</sup> century drawings (LUC Reims). Both Amiens and Reims have lost some of their original stained glass through fires or wars. At Reims, stained glass windows ranging from the 13<sup>th</sup> to the 20<sup>th</sup> centuries are still present. Amiens lost the majority of its stained glass, but still had a considerable amount surviving, providing an extremely light interior to the cathedral. Amiens is also the tallest complete cathedral in France, at approximately 140 feet tall. The figures in the rose windows at Reims are depicted in a very mannered style, which allowed the windows to be dated to around the second half of the 13<sup>th</sup> century. Reims has also been called the lightest cathedral due to its two large rose windows that focus on the Virgin Mary.

A wonderful example of the ever-present goal of “height and light” is actually not a cathedral, but a chapel in Paris called the Sainte Chapelle. The construction of the Sainte Chapelle began in 1246 and was completed in 1248 in the Rayonnant style, which places an even greater focus on maximizing the light within the cathedral as well as the overall appearance of structural weightlessness. The Sainte Chapelle retains one of the most intact in-situ collections of 13<sup>th</sup> century stained glass, which includes an area of over 6,400 square feet causing the walls of the cathedral to become little more than a delicate framework to the numerous windows of the upper chapel. The Sainte Chapelle truly epitomizes the original vision belonging to Abbot Suger of bringing God into the church through heavenly light.

Through looking at the architectural development of these cathedrals throughout the 12<sup>th</sup> and 13<sup>th</sup> centuries, we have observed how the original goals of Abbot Suger ultimately created a completely new style of architecture. The development of stained glass and its inclusion in cathedrals changed the way people learned about religion, as well as forcing advancements in

building methods and architectural techniques that gothic architects employed, and thus, the overall look of the gothic cathedral. In my opinion, a truly “gothic” cathedral may never have existed without Suger’s views and thus we can say that the progression of the gothic cathedral during the 12<sup>th</sup> century and the way we view cathedrals today, all began with the singular concept of bringing God into the church through the heavenly light created by magnificent stained glass windows.

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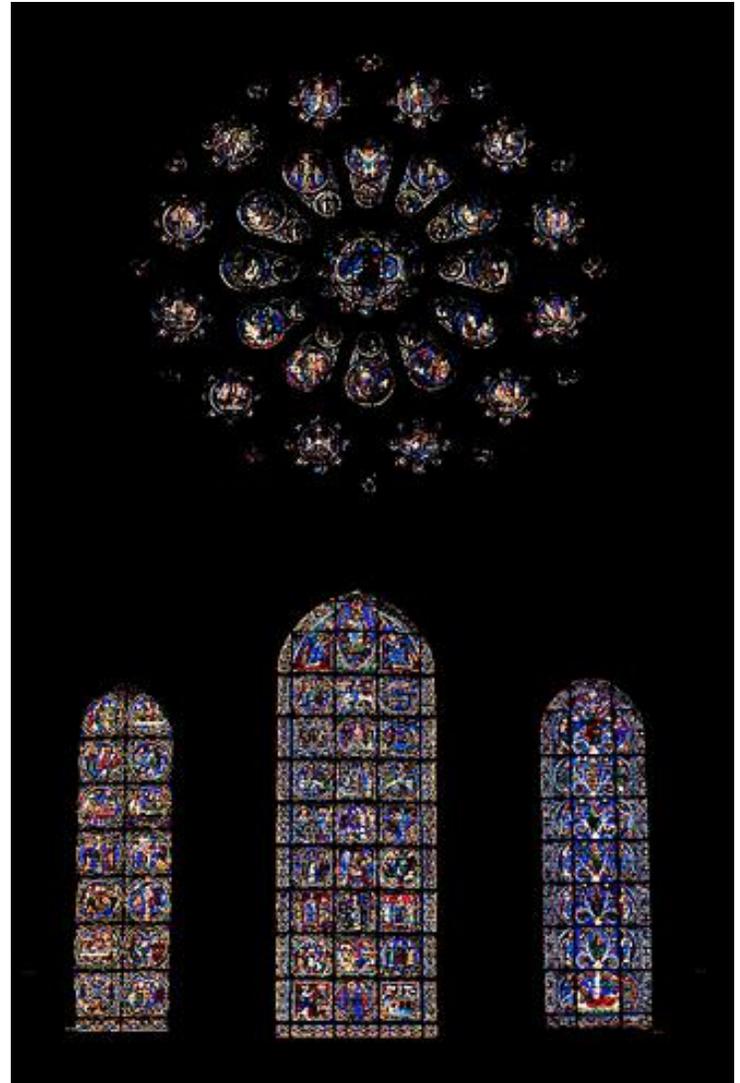
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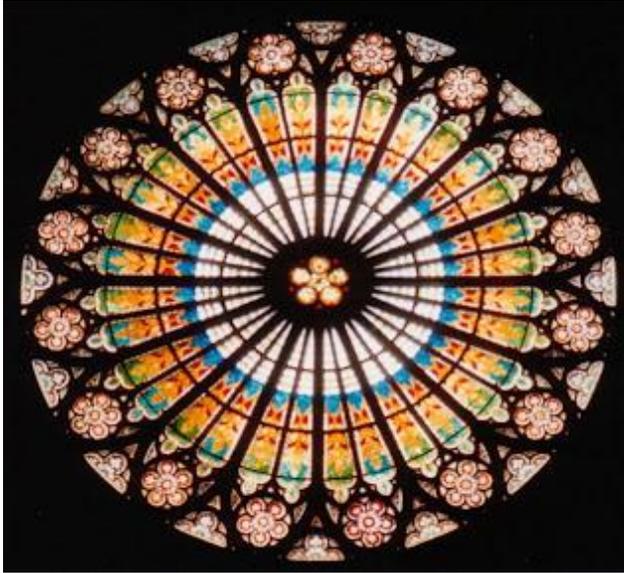
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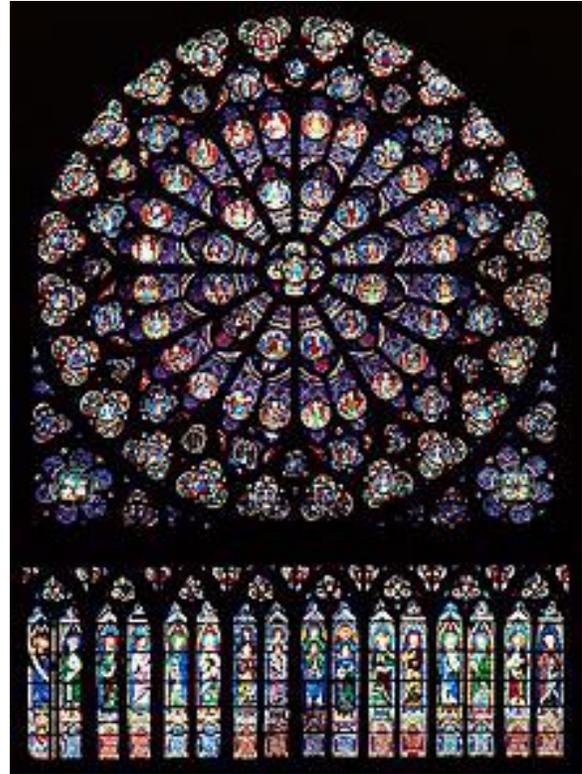
(fig. 1) Tree of Jesse Window, Chartres Cathedral, France, 1145



(fig. 2) Western Rose Window Portraying Final Judgment Scene  
Lancets (left to right): Tree of Jesse, Infancy of Christ, and Passion of Christ  
Chartres Cathedral, France, 1145



(Fig. 3) Wheel Window, Strasbourg Cathedral, France, 1277



(Fig. 4) South Rose Window With Lancets, Notre Dame Cathedral, Paris, France, 1163