

The Gothic Cathedral: An Immersive Information Visualization Space

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Abstract — During the Middle Ages Gothic cathedrals were immersive information spaces which supported religious education and practice. Stained glass windows were essential to their function, in which Biblical narratives had been translated by skilled medieval artists into visual forms. This paper analyzes this visual phenomenon from the perspective of spatial information systems and the medieval art of memory.

Keywords - *information visualization, cathedrals, virtual reality, information spaces, stained glass, immersion, art of memory.*

I. THE CATHEDRAL AS VIRTUAL ENVIRONMENT

The Gothic cathedral was the nexus of Christian religious practice, education, and life. Its architecture was designed to satisfy the desire of people to experience the ultimate religious reality through one's senses. By engaging the visible physical reality of the cathedral, a medieval Christian could directly experience the invisible reality and majesty of Heaven [1]. Its soaring space reaching skyward, thoroughly bathed in light flooding through large stained glass windows, the cathedral detached the individual from the real world sensations of the surrounding village or town. Fig. 1 is an example that shows a picture of the interior of Chartres Cathedral taken at the intersection of the nave and transept. Rib vaulting and gothic arches, externally supported by flying buttresses, create the great space, and open the cathedral's façade to larger stained glass windows. Seen here, they fill bays of the aisles (lower windows), and the clerestory (above the triforium).

Upon crossing a cathedral's threshold, a medieval Christian entered an environment in which real world perceptions had been replaced with sensations corresponding to the cathedral space. Such an experience is an essential requirement of a virtual environment (VE) where immersion removes as many real world sensations as possible, substituting sensations corresponding to the VE, and instilling a sense of belief that one has left the real world and is now "present" within another [2]. Today, a computer controlled virtual world provides those sensory experiences, but the Gothic cathedral of the late twelfth and thirteenth centuries did so by filling an architectural environment with lifelike polychrome sculpture, ambient sounds, orchestrated liturgical music, and religious rites that offered the believer the sensory experience of the sacred, heavenly Jerusalem occupied by God Himself.



Fig. 1. Interior of Chartres Cathedral. Photo: F.T. Marchese.

At a VE's core resides a database of information. For the Gothic cathedral, this was the hundreds of stained glass windows rendering Biblical narratives that had been translated by medieval artists. Light passing through these windows not only bathed a viewer in a matrix of light and color, but immersed him in the word of God. Collectively, these stained glass windows formed an information space that acted as a substrate for religious rites and education.

In the following sections we will explore the nature of this space and how it relates to the medieval art of memory.

II. INFORMATION SPACE

An information space is the set of objects and the relations among them held by a system [3]. In an information space, location and direction have meaning; hence, mapping and navigation among objects become possible. An information object is an abstract data model created to specify information about real-world objects. It encodes a message about the object using an agreed upon language, and in a format that may be decoded at some future time [4]. For example, an email is an information object because it combines symbols (e.g. letters) written in a code or language (e.g. English), and is in a form (e.g. words and sentences) that may be decoded by an intended reader. The layout of these components and their interrelationships define the information object's structure. As an example consider Fig. 2, a portion of a stained glass window sequence from Chartres Cathedral that comprises images from the Book of Genesis - here, images related to Adam and Eve. These stained glass windows were created utilizing symbols (e.g., religious iconography) and form (e.g. arrangements of symbols) organized in such a way to be decodable by an ecclesiastical audience. For example, a monk who viewed the far right scene (Fig. 3), represented utilizing a traditional visual schema, would realize it represents God's creation of Eve from Adam's rib. The layout of these components and their interrelationships define the information object's structure. As an example consider Fig. 2, a portion of a stained glass window sequence from Chartres Cathedral that comprises images from the Book of Genesis - here, images related to Adam and Eve. These stained glass windows were created utilizing symbols (e.g., religious iconography) and form (e.g. arrangements of symbols) organized in such a way to be decodable by an ecclesiastical audience. For example, a monk who viewed the far right scene (Fig. 3), represented utilizing a traditional visual schema, would realize it represents God's creation of Eve from Adam's rib.

The top four of the five panels in Fig. 2 constitute a portion of the information space in which the spatial arrangement of each information object makes navigation possible. Moving across the image from left-to-right and up, scenes from the Genesis narrative are displayed: God breathing life into Adam, Adam dwelling in Paradise, God

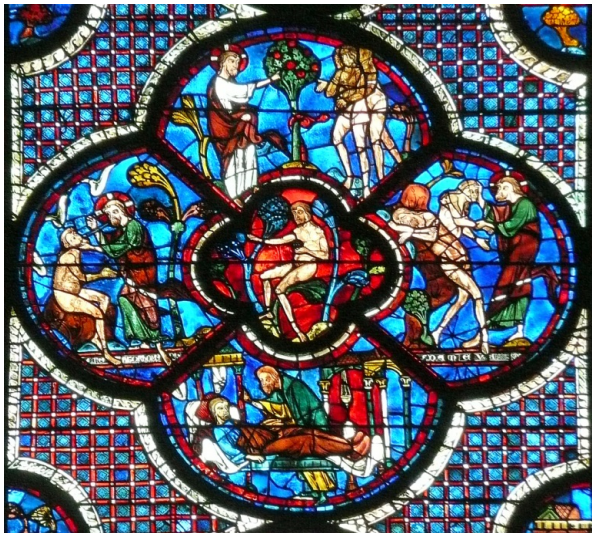


Fig. 2. Chartres Cathedral, partial view of Bay 44 of the Good Samaritan Typological window showing for scenes from the Old Testament story of Adam and Eve. Photo: F.T. Marchese.

creating Eve from Adam's rib, and God warning Adam and Eve not to eat from the tree of knowledge.

Essential to the monk's recognition of the Biblical story was an understanding of the environmental conditions in

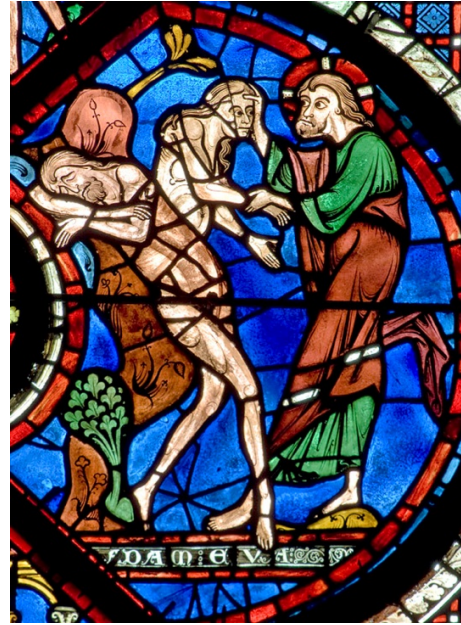


Fig. 3. Chartres Cathedral, Bay 44, panel 15, God creates Eve out of Adam's rib. Photo © Stuart Whatling (MedievalArt.org.uk).

which the message associated with the stained glass image was created, transmitted, and received. Because the stained glass is part of a greater assembly covering a major portion of the cathedral, it becomes an integral part of a rich collection of visualizations of Biblical narratives – a visual information system.

III. CATHEDRAL AS INFORMATION SYSTEM

An information system is that part of an organization that contributes to the distribution of information. An information system is composed of nodes capable of holding information, channels able to distribute information, and agents (human or digital) acting upon information [5]. In general, agents may perform one or more functions related to the handling of information, including selection, filtering, aggregation, presentation, and use. Given the difficulties of human agents to process and retain boundless quantities of information, external forms of memory have been devised as adjuncts to human biological working memory which Clark has termed *external scaffolding* [6]. External scaffolding may take the form of mnemonics, codes, diagrams, photographs, books, rituals, and computer systems, to name but a few. But architectural space may be considered as well.

Let us begin with a kitchen as an example [7]. A kitchen's design transmits the information embedded and encoded within its physical configuration, in its affordances, in equipment and physical artifacts found on counters, in drawers and cabinets. An individual interprets this information employing schema (or schemata), mental representations of objects, settings, or situations that are characteristic of the individual's knowledgebase. A chef encountering this kitchen would immediately understand the quality of its usability based on interpreting the information

encoded within its physical layout and equipment designs (e.g., manufacturer's instructions for appliance use). Beyond its static structure, the kitchen is a ritual space in which the chef executes plans (temporal schema) for the creation of meals.

By analogy, the external scaffolding offered by a cathedral's architecture allowed for embedding and encoding of artifacts and rituals of religious practice within its space. The cathedral's cruciform plan, consisting of nave, transept, chancel (choir), and apse, segments the physical space into zones that accommodate different groups. The nave is the central longitudinal space of the cathedral running from the cathedral's main entry to the chancel. It is where the lay congregation attends religious services. The chancel contains the altar and seating for clergy participating in services. The transept runs perpendicular to the nave at the chancel, providing additional space for clergy. And the apse, a vaulted space terminating the chancel, may contain additional altars. Ritual practices (i.e., temporal schema) afforded by these spaces include the Mass, Stations of the Cross [8], and Passion Plays [9].

The cathedral's stained glass windows were part of the external scaffolding, providing direct access to Biblical stories and the *Golden Legend*, a thirteenth-century compendium of saints' lives by Jacobus de Voragine [10], along with epigrams of moral teaching, and episodes from the history of Christendom. Since each window panel is an information object, displaying a scene from a story; and each panel is logically connected to other panels; then the arrangement of stained glass windows constitutes a spatial information system. As an example, consider the 176 stained glass windows of Chartres Cathedral [11]. Given that there are at least 20 panels per window (c.f. Fig. 1 for an example), then over 3500 panels of information constitute the Chartres visual information system.

Contemporary information systems make light work of indexing and accessing information. Indeed, websites such as *The Medieval Stained Glass Photographic Archive* [12] and *The Corpus of Medieval Narrative Art* [13] offer visual interfaces of hyperlinked cathedral plans and maps of each stained glass window that load any panel from a database for viewing. But during medieval times, accessing this collection of images posed challenges for clerics and laity alike.

Although much imagery contained in stained glass windows is viewable with the unaided eye, there was neither a guarantee that panels would be labelled nor appear to be arranged in a logical fashion. For example, "The Good Samaritan Typological Window" in Chartres merges two Biblical narratives: Adam and Eve from the Old Testament Book of Genesis and The Parable of the Good Samaritan from Luke (New Testament) (c.f. bottom panel of Fig. 2 for a scene from the Parable of the Good Samaritan). Typology is a method of biblical exegesis in which an Old Testament individual or narrative prefigures someone or some story in the New Testament. The Old Testament text is termed the *type* and its fulfillment is designated the *antitype*. For example, Jonah may be seen as the type of Christ because he emerged from death by escaping from the belly of the whale;

while Christ is believed to have risen from the tomb after three days.

Today, the precise typological relationship between the Good Samaritan and Adam and Eve remains open to interpretation, perhaps because its medieval allegorical foundation has yet to be completely understood. Allegory was an important component of Biblical exegesis during the Middle Ages, and was learned as part of an educational process. It was a means of memorizing Biblical narratives and a way of connecting them with their visual counterparts. All this was part of learning the art of memory [14].

IV. CATHEDRAL AS MEMORY PALACE

The art of memory refers to a collection of mnemonic principles and techniques used to organize memory impressions, improve recall, and assist in the combination and invention of ideas. It has its roots in antiquity, documented in the writings of Aristotle, Cicero, and Quintilian. The medieval art of memory (*memoria*) builds on these early authors by focusing on its use for meditation and the composition of lectures, sermons, stories, or poems [15]. These were acts of invention, created by drawing upon an inventory of knowledge that was consumed, broken down into manageable chunks, and correlated.

Visualization and spatial orientation were *memoria*'s most important organizing principles in which every concept is attached to an image, and that image is positioned within the mind's virtual space in an orderly fashion so as to make it easily retrievable and meaningful. As such, architecture becomes the natural organizational construct for spatially arranging information. In the *method of loci*, also called the *memory palace* [14], an individual memorizes the layout of a building, or any geographical entity composed of a number of discrete loci (locations). To remember a collection of concepts the individual *walks* through these loci, and assigns a concept to each locus by forming a mental image between the concept and some distinctive feature of that location. Concept retrieval is achieved by *walking* through the loci to stimulate recall of the desired concepts.

The *method of loci* is external scaffolding that binds the physical-spatial arrangement of the stained glass windows that comprise a cathedral's architecture with the biblical narratives memorized by a monk. Here the cathedral itself provides the loci; not only the position of each window, but also the location of each stained glass panel within the window. So a monk could attach a narrative text directly to the related panel within the cathedral. The strength of this arrangement is that it uses the real architecture as a template instead of an arbitrary spatial arrangement.

V. VISUALIZATION

Medieval man perceived the cathedral edifice and its contents as symbols. Not the symbols used today to show information related to or illustrating a subject, but rather objectively valid definitions of reality that could be understood by looking past symbols' sensate appearances to understand their nature. By moving beyond a literal interpretation of a "thing," medieval man worked at a higher level of abstraction that may be seen as expressed either in



Fig. 4. Reliquary bust of St. Mabille, Siena, 1370 – 1380, painted and gilded poplar wood. (Cl 2624, Musée de Cluny, Paris, France). Photo: F.T. Marchese.

medieval art, or more generally in medieval thought [1]. This implies that although realistic depiction was possible (c.f. Fig. 4), all that was required for medieval visualizations were images with a well-defined iconography.

An iconography is a collection of conventional symbols or images associated with a subject. In the visual arts, iconography is the science of identification, description, classification, and interpretation of symbols and related subjects. Iconography is used to visually communicate with observers who are well versed with the essential underlying texts or theories. The iconographic representation of textural themes such as the Bible evolved from a need to remind the viewer of a story when the text was unavailable. Medieval illustrations of Old and New Testament stories fulfilled this need by building upon an icon's strength, that is, its ability to transcend medium. So, whether imagery is found in illuminated manuscripts, stained glass windows, or carved in ivory, wood or stone, a standard iconography ensured their understanding by an educated viewer.

The relationship of cathedral imagery and its underlying textual information may be viewed in three ways.

The first is that an image visually transmits the essential features of the Biblical text. There is a documentary realism to the imagery. Objects and circumstances are recognizable as authentic to reality. The imagery may even validate the reality of the text through visual confirmation. Seeing is believing. In fact, it may be the reverse for medieval visualization as well: believing is seeing, because the iconography of the imagery plays into the believer's *mind's eye*, wherein the Biblical story is invoked.

The second use of imagery is as a form of argument or a way of phrasing ideas. Biblical stories were not arbitrarily selected for rendering in stained glass, since its creation was a very expensive process. There was a clear agenda for Biblical story selection and placement within the cathedral. Moreover, the selected Biblical stories, particularly those related typologically, had a rhetorical foundation with a

bipartite connection. On one hand, these visual narratives were put in place to convince the faithful of connections between the Old and New Testaments; for example, how prophecies in the former naturally lead to events in the latter. On the other hand, because the medieval art of memory was taught for its rhetorical power, monks so educated could draw upon the cathedral imagery in fashioning sermons.

The third use of imagery is stimulation of an emotional response from the observer. Images are created to express moods which engender psychological interpretation. An important goal for a cathedral was to give the believer a sense of being in the celestial city near God. This is a purely emotional response to an environment in which the light filtering through stained glass windows bathed the viewer in God's radiance, thus elevating him to a higher plane of spirituality. To quote Abbot Suger (c. 1081–1151), the originator of the gothic style of architecture [16]:

Thus, when -- out of my delight in the beauty of the house of God -- the loveliness of the many-colored gems [stained glass] has called me away from external cares, and worthy meditation has induced me to reflect, transferring that which is material to that which is immaterial, on the diversity of the sacred virtues: then it seems to me that I see myself dwelling, as it were, in some strange region of the universe which neither exists entirely in the slime of the earth nor entirely in the purity of Heaven; and that, by the grace of God, I can be transported from this inferior to that higher world in an anagogical manner...

VI. FINAL THOUGHTS

The gothic cathedral was an immersive memory theater in which monks and laity alike could emotionally engage the word of God through its radiant stained glass representations of Biblical narratives. Stained glass windows were populated by a collection of information objects, each representing a scene from a narrative that had been transformed by medieval artists into a visual form. Taken as a whole, these stained glass panels constituted a spatial database system that supported navigation and exploration. Because each panel was rendered employing a standard iconography that enhanced its recognition, it also became possible to connect the tangible visualizations in the material space of the cathedral with mental imagery created as part of the medieval art of memory process. In so doing, the physical, external scaffolding afforded by the cathedral could be bound to the cognitive scaffolding created as part of the memory palace. As such, a monk could freely move between material and immaterial as part of meditation or preaching.

REFERENCES

- [1] O.G. Von Simson, *The Gothic Cathedral: Origins of Gothic Architecture and the Medieval Concept of Order*, Bollingen Series (Vol. 48), Princeton University Press, 1962.
- [2] M. Slater, A note on presence terminology. *Presence Connect*, vol. 3, no. 3, 2003, pp. 1-5.
- [3] G.B. Newby, "Cognitive space and information space." *Journal of the American Society for Information Science and Technology*, vol. 52, no. 12, 2001, pp. 1026-1048.

- [4] P. Van Garderen, Information as an Object. Message, 2007, February 5, posted to <http://archivemati.ca/2007/02/05/information-as-an-object/>.
- [5] J. Palmius, Defining the information part of information system: a base for simulation. In IRIS 28: Proceedings of the 28th Information Systems Research Seminar in Scandinavia. IRIS 28, Kristiansand, Norway, August 6-9, 2005.
- [6] A. Clark, Being there: Putting Brain, Body, and World Together Again Cambridge, MA, The MIT Press, 1997.
- [7] M. Boisot, Exploring the information space: a strategic perspective on information systems [Online Working Paper]. IN3-UOC: (Working Paper Series; WP04-003), 2004. Retrieved February 21, 2014 from <http://www.uoc.edu/in3/dt/20415/index.html>
- [8] G.C. Alston, Way of the Cross. In The Catholic Encyclopedia, New York, Robert Appleton Company, 1912. Retrieved February 28, 2014 from New Advent: <http://www.newadvent.org/cathen/15569a.htm>
- [9] A. Salzer, Passion Plays. In The Catholic Encyclopedia. New York, Robert Appleton Company, 1911. Retrieved February 28, 2014 from New Advent: <http://www.newadvent.org/cathen/11531a.htm>
- [10] J. De Voragine, The Golden Legend: Readings on the Saints, trans. William Granger Ryan, 2 vols. Princeton, Princeton University Press, 1992.
- [11] P. Frankl, The chronology of the stained glass in Chartres Cathedral. Art Bulletin, 1963, pp. 301-322.
- [12] P. Cowen, The Medieval stained glass photographic archive. Retrieved February 21, 2014 from <http://www.therosewindow.com/pilot/>
- [13] S. Whatling, The corpus of medieval narrative art. Retrieved February 21, 2014 from <http://medievalart.org.uk/>.
- [14] F.A. Yates, The Art of Memory (Vol. 64). Random House, 1992.
- [15] M. Carruthers and J.M. Ziolkowski, eds., The Medieval Craft of Memory: an Anthology of Texts and Pictures. University of Pennsylvania Press, 2004.
- [16] Abbot Suger, Abbot Suger: On what was done under his administration, XXXIII, c.1144-8. Retrieved February 27, 2014 from http://learn.columbia.edu/ma/htm/ms/ma_ms_gloss_abbot_sugar.htm#book1.