



Design Example of Catalyst Effect Analysis with Topological Graphing

Yaqi Liu

School of Architecture, South China University of Technology, Guangzhou 510006, Guangdong, China
DOI: 10.32629/aes.v3i3.982

Abstract: Urban catalyst theory is based on the excavation of the phenomenon of "mutual stimulation of elements", designing and amplifying the synergistic effect between elements, that is, the catalyst effect. In this paper, the topological analysis framework of the dotted-line relationship of physical space is introduced, and it is found that the topology of the catalyst effect has distinct characteristics. This is a minor innovation in the understanding of urban catalyst theory. A case of urban catalyst theory illustrates a full process of transforming the elements that produce the catalyst effect from "grand-centered structure" to "polycentric structure" to "distributed structure". Starting from the classic case, this paper reproduces and further shows the occurrence process of the catalyst effect from the perspective of topology, and uses more cases to show the design of different types of catalyst effects, providing new ideas and references for future design on catalyst effects for different situations.

Keywords: urban catalyst theory, topology, Guggenheim Museum, Hack Snow Courtyard

1. Introduction

The theory of urban catalysts was proposed by American architects Don Logan and Wayne Otto in *American Urban Architecture — Catalyst in the Design of City*. Catalyst theory borrows a metaphor for the concept of a chemical catalyst to trigger a cascade of value enhancements through the introduction of one or a limited number of new elements. On the one hand, this value enhancement is spatially inclusive: the introduction of new elements can react with more elements within the reach of the community, or with some element in the vicinity, and the combined reaction of these elements can further connect with more elements in the block. On the other hand, this value improvement is also in the continuation of time: the introduction of new elements can enhance the value of a certain aspect of the neighborhood for a long time, bring synergistic economic benefits, cultural values or humanistic care to other elements, and promote the continuous renewal and development of the overall precinct.

The whole process of the catalyst effect is particularly clear through the display of the topological dot-line diagram. These design ideas for different situations can be more widely and standardized to many other urban renewal projects. The urban catalyst theory, which combines topology analysis, will have stronger practicality and universality, and provide more practical ideas for subsequent urban stock transformation projects and urban planning.

2. Topological analysis of the catalyst effect

2.1 Grand-centered topology

From the perspective of topology, the above development process is from the "grand-centered structure" to the "polycentric structure", and finally become the layout of a "distributed structure" (Figure 1). The center in the grand-centered structure is the entry point of the catalyst effect planning, because it is the first to start in the entire transformation with utmost importance and duration. So it is necessary to choose the most comprehensive or deepest advantages with respect to economy, transportation, flow of people, industry. The center as a catalyst entry point can bring several benefits: First, the development of this urban core is easier and better effecting, which can drive investor confidence for follow-up planning; Second, it can be relatively easy to superimpose the advantages that have been formed in history, bringing a steady stream of spillover effects to the surrounding buildings; Third, it is generally in the center of the city, and the distance from other parts of the city is relatively moderate, and when planning further catalyst effects, it is less likely that it will be in a corner of the city because of the location it is located in, and there will be an imbalance between one over the other.

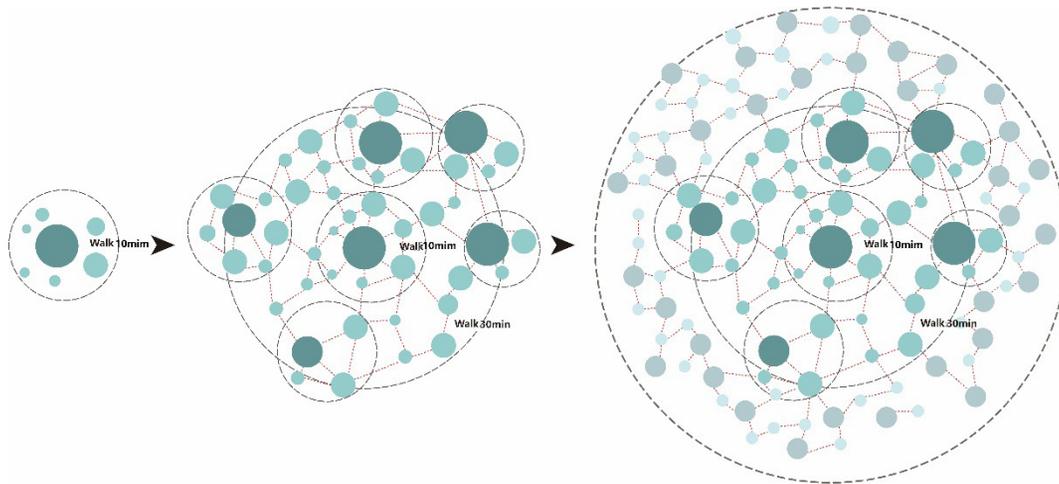


Figure 1. Evolution from large centers to distributed structures

Image source: Author's own drawing

2.2 Transition from a grand-centered topology to a polycentric topology

Secondly, how to spread the core building of the grand center into a multi-center building group. The catalyst effect of grand-centered structures generally considers only a few aspects of value spillover, such as commercial value. However, in order to enrich the sensory content that can be obtained by a trip in each tourist's visit, it is necessary to connect the buildings of different natures that can organically constitute the content of people's daily travel. The connection between these buildings is naturally generated in accordance with economic laws — people's economic activities and social activities have natural laws, and the functions that meet the needs of a lot will naturally survive, and those that do not meet will be eliminated; There are also artificial designs – non-profit, non-market-oriented buildings are built based on the dimension of public interest considerations, and their construction is based on the value that local governments or non-profit groups want to add or preserve for the locality.

No matter what type of building or facility, as long as they come together and coexist for a long time, they will naturally evolve to complement each other in function. But the connection between them, as the course of history progresses, may also be unreasonably broken by some nascent conditions. Such as the modification of roads, the narrowing of sidewalks, the construction of new facilities, etc. In addition, the relevance between buildings is not undesignable. Repairing, supplementing, or enhancing, or adding transportation links and economic links between buildings is the main idea of transforming from "large central structure" to "polycentric structure".

2.3 A polycentric topology extends to a non-centralized topology

The extension from a "polycentric structure" to a "distributed structure" is a process that continues to diffuse and reap the fruits. At this time, early investors have already reaped the rewards of successful investments, and later investors are concerned about the commercial value already reflected in the core groups, and may continue to develop new groups in the surrounding areas for the sake of commercial interests. At this stage, the design of the catalyst effect is actually nearing the end, and more economic benefits, cultural values, and life values are generated by the capital and population gathered by nature.

However, the development of this stage is not without intervention, and the main idea should be to control the development direction of new groups according to the positioning set when designing the catalyst effect, so as not to let their short-term economic goals run counter to the long-term development direction of these regions. It is true that a region is not necessarily positioned in only one direction, especially within the urban area of medium-sized and above; In the course of time, the planning of the direction of development of a region also needs to be appropriately adjusted after a period of development. But the idea is still consistent: the development of the city should be a process of continuity and synergy between each other.

3. Guggenheim Museum – from grand-centered structure to multiple-centers structure

Bilbao is the central city of northern Spain, and is the largest steel and chemical center in Spain. Originally a small port inhabited by local seafarers, Bilbao was founded in the 13th century. In the 19th century, Bilbao relied on the iron ore resources around the city to develop the steel and metallurgical industries, and with the advantages of land and water transit

and tax exemption policies, it became the economic center of the Basque Country in northern Spain and an important port city in Europe, and the banking and securities industries also rose at the same time.

By the 1970s and 1980s, the economy of Bilbao had been severely hit by the decline in the competitiveness of the city's industries due to the import of cheap foreign labor, and multinational enterprises had moved out, with an unemployment rate of 25% of the population.

In order to change the situation of urban decay, the Bilbao municipal government tried to promote urban development by governing the internal environment of the city and building new projects. The municipal government has proposed to promote urban rejuvenation through cultural industries, but many cities in the country are seeking similar transformations. Therefore, getting Bilbao's cultural industry on track requires a global cultural-oriented project.

At this time, the Guggenheim Foundation in the United States was also eager to carry out strategic layout in Europe. He was brokered and promoted by Carmen Giménez, who was an executive adviser to the Spanish Ministry of Culture and then head of the Guggenheim Museum branch in New York, The Bilbao Municipality, the Basque Regional Government and the Guggenheim Foundation have decided to plan a new cultural landmark in the heart of Bilbao. Located on the edge of the old town, in the art area on the south bank of the Nervión River, the project has a main elevated passage into the city that crosses the corner of the base, which is the only way to enter the city from the north and the gateway to the city of Bilbao. After layers of screening, the draft museum designed by architect Frank Owen Gehry was finally selected, which is the prototype of today's Guggenheim Museum.

The Guggenheim Museum, designed under Gehry's auspices, was finalized in 1991 and completed in 1997. Due to its unique shape, the Guggenheim Museum in Bilbao itself has received a lot of discussion after its completion. According to the World Architecture Survey organized by Vanity Fair magazine in 2010, the museum is one of the most frequently mentioned terms in the field of specialization. Whether it is criticized or not, the worldwide effect that the museum originally hoped to obtain has indeed been realized. In the first six years of the museum's opening, it brought 166 million euros of investment to the urban area, attracting more than 4 million tourists every year, and its ticket revenue still accounts for 6% of the municipal revenue, and the museum-related industry accounts for 30% of the city's output value. The influence of the Guggenheim Museum in Bilbao is known as the "Bilbao effect".

More crucially, the Guggenheim Museum has helped the city of Bilbao realize the transformation of the city. By 2008, the city had 2,038 arts and creative enterprises, accounting for 5% of the total number of enterprises in the city. To expand the influence of the museum, the local government has also built other cultural projects along the river, further helping the city transform from a traditional industrial city to a creative city.

Undoubtedly, the museum plays a decisive role in the economic recovery and functional transformation of the entire city. The urban regeneration process of Bilbao has many similarities with the aforementioned case of Milwaukee. But the difference is that most of the successful projects and policies that the city promoted during and after the construction of the museum were based on the huge influence of the museum. The Guggenheim Museum has become a veritable main engine for the development of emerging industries. The catalyst effect it brings has successfully transformed the city into a city of art and creative industries, successfully promoted economic development and the improvement of the city's image, and successfully curbed the Live the fate of urban decay.

To sum up, the main purpose of the grand-centered topology is to radiate the surrounding area with a carrier with a strong catalytic effect. The typical method is to build a landmark building to improve the popularity of the area. This method is generally used to drive decline or development in less developed regions.

4. Conclusion

The urban catalyst theory belongs to the combination theory of gradualism theory and advocacy planning theory. On the one hand, the urban catalyst theory applies the gradualist theory's understanding of the limited rationality and puts the idea of incremental transformation into practice; on the other hand, the urban catalyst theory still does not fully trust the collective rational discussion, and the conclusions obtained That is the best conclusion, and still insist that the mind of the designer is dominant - this is more realistic approach. The urban catalyst theory has developed the connotation of two theoretical ideas at the practical level, and made further play in feasibility and commerciality. This paper lists the most representative examples of urban catalyst theory, and through further data collection, the ideas and ideas of the designers at that time are restored to the greatest extent possible, and different types of catalyst effects are displayed with topological structure, which can provide the design catalyst effect for future generations. new ideas.

References

- [1] Silkharich, Jiao Xue. Creative Bilbao: The Guggenheim Effect [J]. *International Urban Planning*, 2012,27(03):11-16.
- [2] Wang Changsong, Tian Yun, Liu Peilin. A Comparative Study of Foreign Cultural Planning, Creative Cities and Urban Renewal — is based on a literature review [J]. *Urban Development Research*, 2014,21(5):110-116.
- [3] Silk Haarich, Beatriz Plaza. Translated by Jiao Yixue. Creative Bilbao: The Guggenheim Effect [J]. *International Urban Planning*, 2012,27(03):11-16.
- [4] Jiang Wei. A Comparative Study on the Renewal of the Sino-German City Center Mixed Industrial and Commercial Residential Historic District — takes the Hacksnow Courtyard Group in Berlin and the Tianzifang in Shanghai as examples [J]. *Studies of Modern Cities*, 2012,27(01):34-46.