The Power of Iron

A Researech on Horta's Personal Language of Iron Materials

Dan Xie

5275180

09.04.2021

Abstract

As one of the most prestigious architects of the Art Nouveau period, Victor Horta explored a set of innovative methods to combine iron materials and architectural forms. This article will focus on this particular material language, first analyze the background of iron materials and architectural development at that time; secondly, analyze the characteristics of iron material itself to discover opportunities for its integration with architecture; finally, through analysis of architectural cases, it will discover the specific design of Horta for iron materials technique, so as to summarize his personal material language.

From the perspective of architecture, this new material brought both opportunities and challenges to Horta. This article hopes to analyze Horta's design strategy not only at the operational level, but also at the conceptual level to explore how to creatively combine new materials for architectural design.

Keywords: Iron, art nouveau, Victor Horta, structural logic, innovative material practice

Table of Content

Introduction

During the Art Nouveau period, traditional architectural design methods were challenged from many aspects. The exchange of art and culture from the East made people begin to admire the aesthetics of natural patterns; the British Arts and Crafts Movement made people refocus on the honest expression of handcrafts in architecture; the industrial revolution brought new production technology, and also brought the aesthetics of industrial temperament to the society and the new material that came into being-iron. Faced with the integration of this series of changes, architectural design is constantly combining new characteristics to develop itself. Among them, iron materials, which seem to be the most basic ones, have the most profound impact on all aspects of the architecture field. From structure to decoration, iron is extremely widely involved in architectural design. Among those architectural practices that incorporate iron, Horta's application of iron art is the most notable.

Inspired by the theoretical fundaments of Viollet-le-Duc’s work, Horta has put Art Nouveau concepts into practice from 1893 onwards. This led to the construction of remarkable iron structures. (Collette, Wouters, De Bouw, Lauriks & Younes, 2010) The background of the times and technological development created the possibility for the application of iron materials: the industrial revolution allowed iron to be mass-produced; theoretical research and experiment tests helped people understand the mechanical properties. However, the mainstream cognition at that time still believed that iron were closely related to industrial buildings. Horta's work greatly broadened the application range of iron materials at that time.

This article will analyze the application of iron materials in Horta's works to explore what changes iron brought to the architectural field. First, why does Horta chose iron materials? Why does iron have the unique possibility of combining with architecture? How does Horta explore this possibility? How is this creative design reflected in his work? We will analyze these issues one by one, and finally try to analyze his material language. Furthermore, this article hopes to deepen the understanding of different materials in construction.

Charpter 1. Social Context

New Requirement in the New Era

During the Art Nouveau period, the wave brought by the Industrial Revolution swept the entire society. People's lives were changing in terms of both crafts and concepts. At the craft level, new industrial technology leads the innovation of construction; at the conceptual level, people are inspired by Eastern artistic styles and industrial architecture, and there is a trend of combining these new elements in the aesthetics. In this context, architects needed to provide new solutions to meet the requirement in this period.

In addition to the overall social aesthetic and technological changes, a new class was also pushing architecture to find new styles. An enlightened bourgeois class sought out a new artistic style to reflect their progressive political views and to separate themselves from the conservative elite. As is the goal of the client, when a pedestrian walks down a Belgian street and notices one of Horta's profoundly different art nouveau houses, he presumes the owner to be a forward-thinking liberal. (Kooning, 1999) According to Horta, a house “should not only reflect the life of its owner, but also be its portrait.” (Kooning, 1999) Therefore, residential design became a symbol of this class's personal identity and aesthetic appeal. This symbolic role of social status provided a huge demand for the architecture market. This gave architecture sufficient motivation to find new possibilities for itself.

Why Iron?

At that time, iron materials were closely related to industrial buildings. This led to the fact that people at that time did not accept its application in house, which should have a warm feeling to people. In addition, the application of iron lacks standards, and the cost is quite expensive. These reasons led to the fact that even in the 1890s, iron was only used in factories, railway stations and office buildings, but it did not appear in houses for a long time. (Liang, 2020)

With the development of theory and experimental test, people have found ways to improve the performance of iron. At the same time, iron components with different specific shapes have been developed, so that the cost can be saved as much as possible while reducing the weight as well. These technological innovations have led iron to new possibilities. (fig. 1)

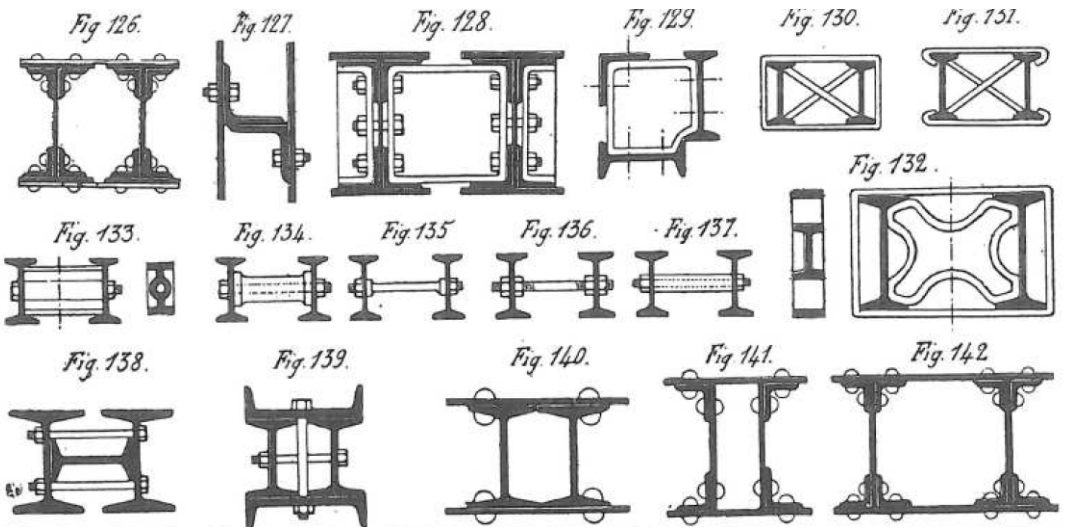


Figure 1: Example of several composed beam types made of shapes or twin beams

The development of technical support ensured the diverse uses of iron, and gradually changed the role of iron from an auxiliary structure to a more obvious independent existence. Since iron materials are easy to process and have excellent mechanical properties, they can play important role in both structural and decorative levels. For example, Horta was very keen on the beauty of the whip line, and constantly tries to apply it to the decorative pattern of the building. Iron can undoubtedly take on this role, since it could extend and bend freely to express the shape of the natural world.

In addition, the impressive split-level space in Horta's works is also realized with the help of iron. There is an exploration of modernism in his work, which is embodied in the constant opening of interior and liberation of space. The flexible and light characteristics of iron can meet these needs. By using iron as the supporting structure, the position of the traditional stone load-bearing wall can be replaced, so that the indoor and outdoor walls are more free

to be opened. At the same time, more spaces can be linked together. This makes the interior space has more possibility, rather than confined to the strict superposition of different levels of floors like traditional classical buildings. The influence of iron material is not only reflected in the visible structure and visible decoration, but also affects the organization of the space at a deeper level.

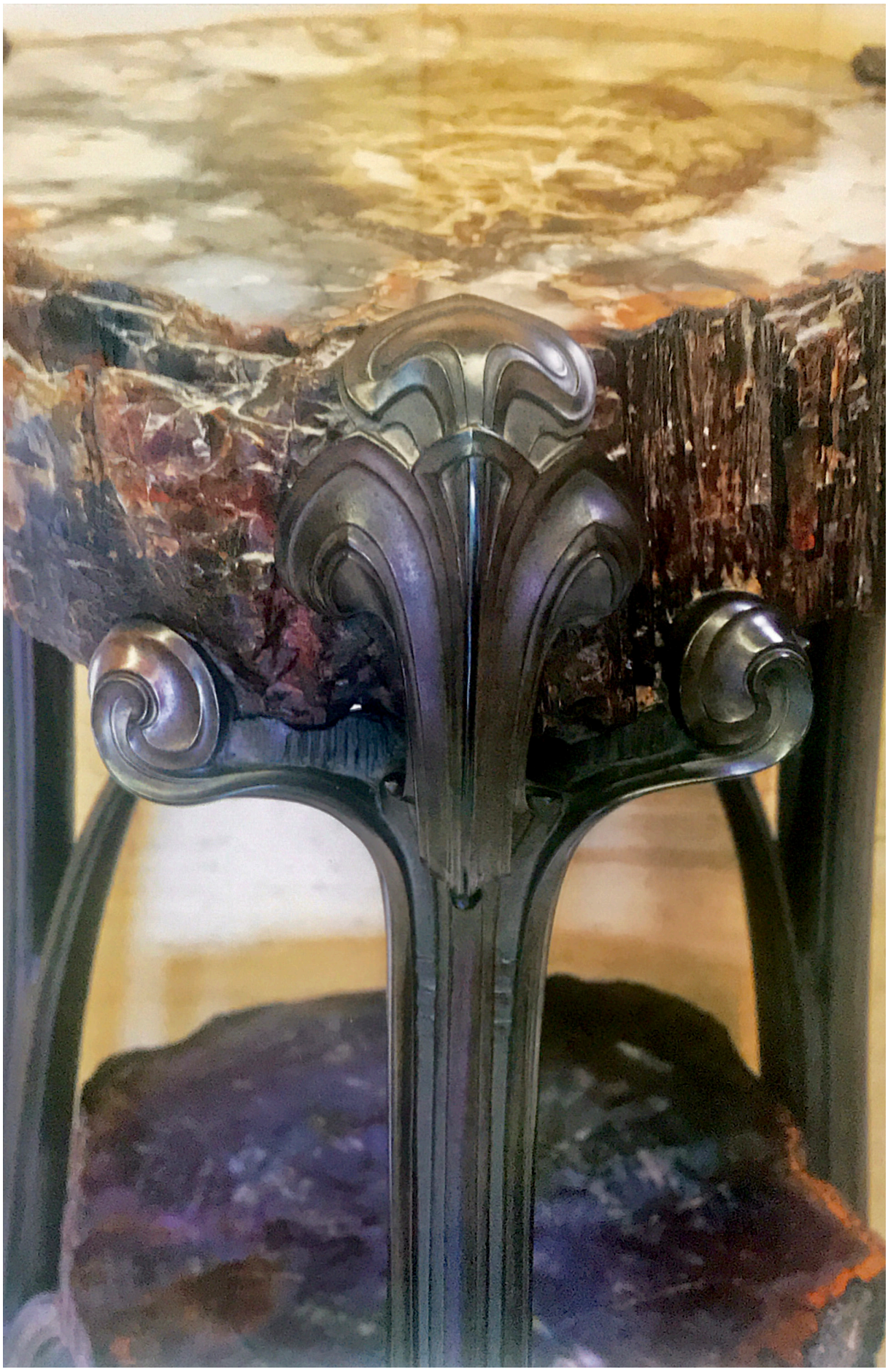


Figure 2. Detail of the table in the living room of Horta's house

Charpter 2. Material Logic

Follow the Material

Art nouveau movement considered that each material type should be represented by its own formal expression according to its properties. And in Horta's theory, the use of a new material had to be reflected by the usage of new forms (Collette, Wouters, De Bouw, Lauriks & Younes, 2010). The connotation of this theory is similar to that of another theory, which is proposed by Ingold. He advocated that art is a question not of imposing preconceived forms on inert matter but of intervening in the fields of force and currents of material wherein forms are generated. (Ingold, 2009)

The design of materials is a process of "giving form". The designer is not in absolute dominance in this process. The load-bearing design of the material needs to respect the mechanical properties; the artistic design of the material needs to consider the touch of the surface, the visual texture, the perception of color and gloss. Designers extract original raw materials from the natural world and then adapt their original material field to a new field.

It should be said that Horta has "followed" the nature of iron to realize the exploration of new forms, rather than just treating iron as a decorative language. The figure 2 shows a detail of the corner of the table designed by Horta. Iron and wood form a clear supporting relationship. We can observe a lot of details from the material itself: the iron table leg has a lot of vertical stitching, and the thickness of the two ends is also slightly different from the middle part. The design of this line and shape shows a kind of the beauty of stretching and growth, which echoes the process of wrought iron that changes from liquid solidification to solid states. And where the two materials meet each other, the support point of the table legs to the table, the texture of wood and iron have a very dramatic conflict. The wooden tabletop is retained with a cross-sectional texture. While the corner of the iron table at the junction point, forming a natural and smooth enlarged node, which extends to both sides and above, perfectly supporting the rough wood. The delicate and smooth artificial lines meets the plain and

original natural textures, forming a sharp contrast and constitute a harmonious coexistence at the same time. The characteristics of this magnified material can be seen in Horta's works. His material language first starts from the material itself and then combines the function and form of the furniture or the building itself to become a complete design.

Material as Personal Expression

Horta's expression of materials seems to reflect concerns from many aspects, such as natural form and industrial temperament. But if you carefully observe his design works, you will find that his personal expression is mixed with more complicated intentions, rather than simply reflecting one single part.

When we focus on the natural forms in Horta's works, we can easily find many details to support this argument. For example, the lines of naturally curly iron crafts, the dividing lines on iron pillars and beams like the texture of trees, and the large number of curved elements appearing on skylights and wall window frames. But it is not difficult to see that Horta has personally abstracted and refined the original natural form. This makes it impossible for people to directly find out which plant he is imitating, but can make people feel natural and organic at the overall level. Horta never incorporated a direct or explicit imitation of flora but was rather inspired by natural forms. This subtle distinction lends his works their ultramodern feel relative to their time. He was not portraying nature but featuring its beautiful tendencies in an edifice that connotes rigidity and inflexibility. (Kooning, 1999)

And, it would also be misleading to assume that Horta was outright enthusiast for the technology of his age and the rationalism of its structures. (Dernie, 1995) When we examine his works from a purely engineering perspective, we will find many contradictions. Although the overall structure has a response to the structural logic, there are many useless decorative operations that exist as well. In figure 3 it shows a structural details of the Solvay house. First of all, the various irregular components do not meet the structural rationality standard. Such a structure undoubtedly makes the measurement and design of mechanical properties more complicated. In addition, there are many decorative small components extending

outward, which plays an auxiliary role for the main load-bearing system. Similarly, if it is based on structural rationality, here will be a more concise formal operation. Finally, this detail embodies a sense of beauty that is as complete as a sculpture as a whole. This quality is also reflected in many other works of Horta. His structural details are more like artistic than technical expressions. This display on the aesthetic level is also not guided by mechanical properties.

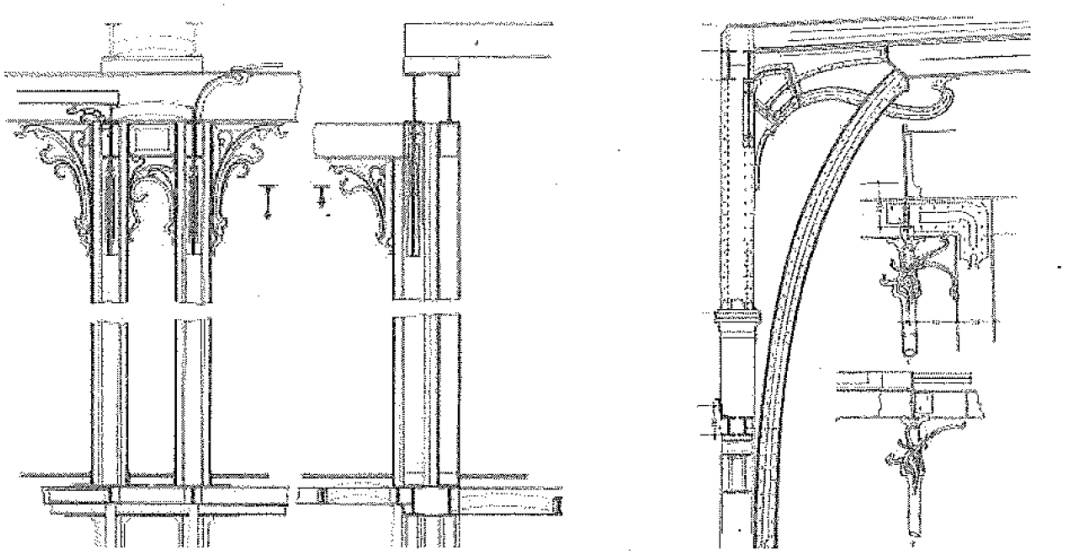


Figure 3. Construction detail of the Solvay house

In summary, it can be found that Horta's material language is the result of a more comprehensive combination of many different characteristics. His works are also closer to the expression of personal aesthetics rather than structural or functional logical processes. Of course, this is a very general statement, which manifests itself as a more complex operation at the practice level. To understand his personal design tendencies, it is necessary to study his works more specifically to discover patterns.

Charpter 3. Case Study

Case Selection

This article selects three representative works of Horta. They are the Tassel house, the Van Eetvelde house and Maison de People.

Each of these three projects has different characteristics. The Tassel house is the first time that Horta has used his complete set of material language successfully. This building presents Horta's first mature residential model, where all architectural elements achieve complete unity and harmony. The Van Eetvelde house is integrated into the large indoor space design on the basis of Tassel house. The iron material has a very remarkable performance here. Maison de People is a public building, which has very different functional requirements from residential buildings.This building represents the working class in society at that time and their achievements. Such social significance and commemorative value put forward different proposition. By observing the design strategies for iron under different design requirements, his design techniques could be more clear and readable.

Figure 4. Tassel house, 1893-1897

Figure 5. Van Eetvelde house, 1895-1901

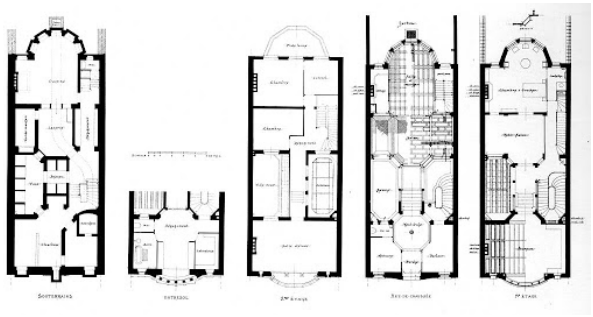
Figure 6. Maison de People, 1896-1899

Analysis Content

The part of the case analysis starts with the performance of the iron on the main frontage. Basically, the main facade of the building. This part will analyze the specific role of iron in the main frontage.

Secondly, it will specifically analyze the design of the iron component itself, including the decoration and artistic treatmen. Try to find what are the expressions of materials, in terms of decoration and construction. The third point is about the spatial style achieved by iron materials. This part will mainly analyze the role in the free and flexible spatial layout in Horta's works, which is the impact of the structural system on the spatial system. Finally, we will analyze the artistic atmosphere created by iron. This part will start with the more perceptual aspects such as the overall color and decorative patterns of the interior. Try to find out what different atmospheres the iron creates.

1. The Tassel house, 1893-1897



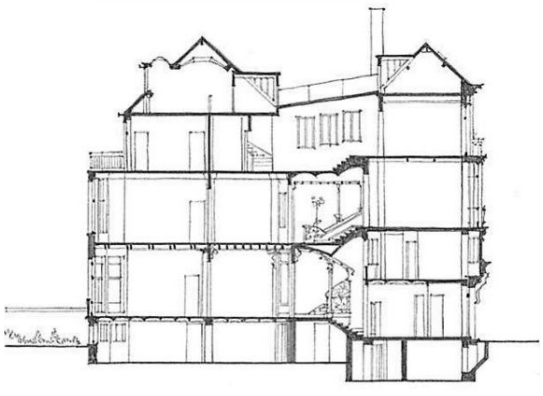


Figure 7-1, 7-2, 7-3. The Tassel house

1.1 Main Frontage

On the facade of the building, curved windows combine the curvilinear beauty of the building with the plastic extensibility of iron. It can be clearly seen that Horta has different structural treatments for the windows of each floor. The bottom layer is supported by solid stone. On the second floor, the protruding building volume in the middle of the building began to appear, and iron beams began to appear. Although the supporting structure is still stone, the form is replaced by lighter and slender stone columns. On the third floor of the façade, the proportion of the central body is further expanded, and the proportion of the glass surface is also increased. All the structural components here have become wrought iron components: slender iron pillars replaced stone pillars, and at the same time, Horta shortened the most central pillar into a railing to make this sense of center more obvious. The protruding shape in the center of the facade ends on this floor, and the uppermost building is restored to its flat state. Together with the horizontal lines on the stone walls on both sides, the facade of this floor seems to be completely out of the same plane as the lower floors. The glass surface area of this layer has a larger specific gravity. In the end, the iron art component on the top ends the closing of the entire facade and the sky.

On the entire facade, the style of the central volume becomes light and transparent layer by layer from bottom to top. The supporting effect of iron materials and the specific gravity of the glass surface are increasing. Horta uses different materials to show a visual effect of weight. This form seems to be a perception of gravity. The windows on both sides of the facade have gradually narrowed and become smaller, which strengthens the perspective of human eyes and makes the whole building look more three-dimensional.

1.2 Spatial Logic Reflection

The floor slab in this building has a very rich variety. The dislocation in height gives the space in the entire building a sense of extension and continuity. People can always see scenes of other spaces at different heights in the field of vision. (fig. 8-1) This spatial characteristic is because Horta combines the traditional stone load-bearing structure with iron, which liberates

a part of the wall of the interior space. He then created the required spatial continuity by arranging these walls in specific positions and opening their surfaces, such as the continuity between the staircase and the central space of the house.

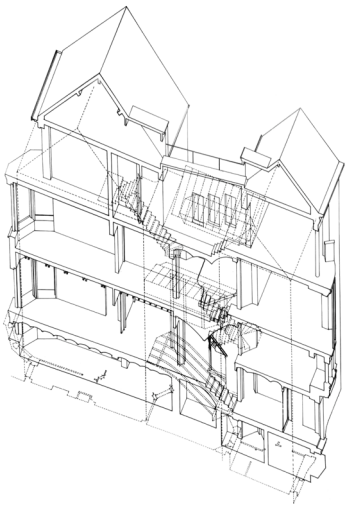
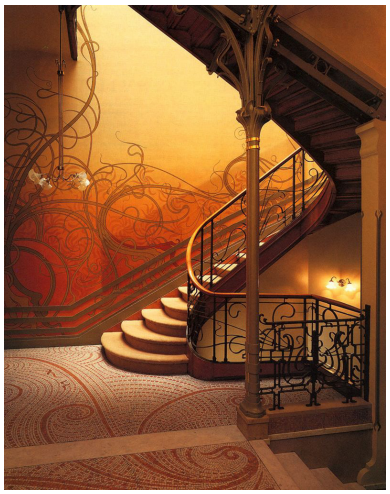
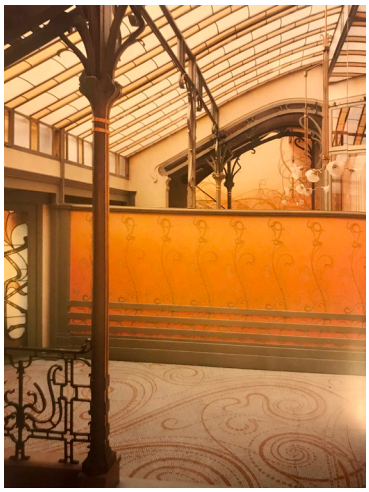




Figure 8-1, 8-2, 8-3. The interior of the Tassel house

The figure 8-2 shows the most famous staircase here. Horta emphasized the side line of the staircase and made a very rounded treatment. This line continues from the lower level to the upper level, and even has a very smooth transition at the floor. The same is done for the handrails of the railings. The armrest also presents a very overall sense of line. Coupled with the continuous repeating of subway art patterns on the railings, the entire handrail resembles a flat figure, extending infinitely in the space of the stairwell. The same treatment is also reflected in the skylight on the top floor.(fig. 8-3) The lines extending on all the railings and the downward lines of the obvious iron structure on the outside of the railings seem to lead this space in two different directions.

This kind of iron structure's response to space is actually the reason for this kind of space. Horta cleverly arranged the exposure of these structural parts to organize people's visual effects, and finally unified the structure and space.

1.3 Iron Component Design

As figure 9 illustrate here, Horta made a lot of decorations for the iron columns. He enlarged the size of the top column head and the bottom column base, but used a different technique: at the bottom, this enlargement is manifested as an enlargement of the body itself, which gives people a solid and steady feeling on the mechanics level. At the top, this kind of magnification appears in a more transparent way. By extending the different decorative lines on the pillars and echoing the components on the ceiling, the pillars seem to disappear in it, making it impossible to clearly say where the specific structural pillars stop.

Figure 9. The enterance space

In addition to physical manipulation, there are many decorative lines on the surface of the pillars. There are some horizontal lines at the bottom and the top, and the bottom is thicker. There are corresponding vertical lines at the protruding or changing positions on the pillar shape. These lines eliminate the mechanical feeling of iron products to a certain extent, and replace them with a feeling of organic growth.

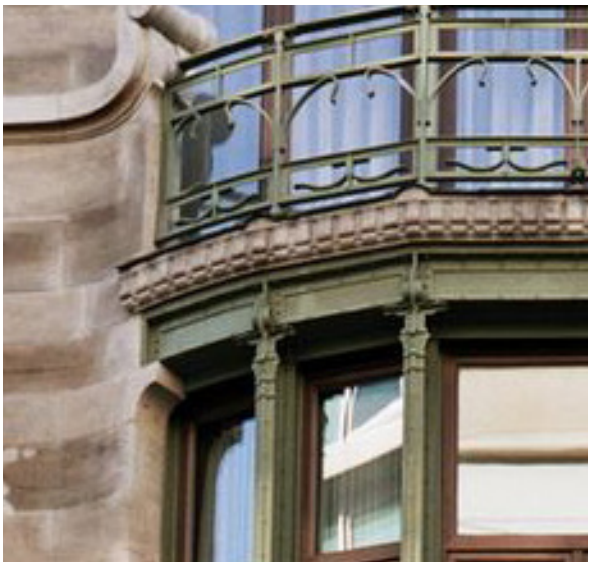



Figure 10-1, 10-2. The details on the facade

The junction between the iron pillars and the horizontal members on the facade has been treated very specifically. The vertical members do not end straight on the horizontal surface, but are used to extend the shape of a plant to more gently envelop the horizontal beams. The "bone" shape interface implies a kind of "occlusion" between the column and the horizontal floor, forming a non-static visual effect. (Zhang, 2018) The style here is taken from the extended form of plants. The gray-green color is used, which gives people a feeling of extension like vines. At the same time, this is also a more aesthetic expression of the structural relationship between the basic elements of architecture, beams and columns.

A similar technique is also reflected at the head of the pillar in the room. The indoor structural junctions show a more artistic extension. In this picture, the iron pillar itself has a lot of vertical line divisions, which gives it a sense of growth like trees in nature. At the top, each line extends outward, corresponding to the lines in different directions on the ceiling, presenting a connection and supporting effect.

1.4 Space Atmosphere

The main colors in the Tassel house are red and yellow. The role of iron in this house is very soft. The exposed iron pillars and decorative iron components are in dark tones. When the light from outside shines on the stained glass in the house, the iron components also appear

slightly brown. In the pattern, the form of the iron art component is very similar to the pattern decoration on the wall, which further weakens the hard and artificial coldness of the iron itself, and creates a visual affinity. It can be said that the iron component here embodies a low-key and soft effect that blends into the background. This characteristic makes the interior of the tassel house present a warm sanctuary feeling.

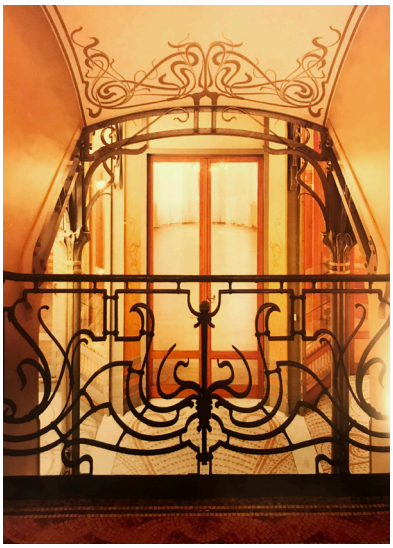


Figure 11-1, 11-2. Interior atmosphere

2. Van Eetvelde house

2.1 Main Frontage

In the Van Eetvelde house, Horta no longer used a language of carved stone and intricately curving ironwork: a more deliberate rhythm of iron bays is expressed as an independent element, cantilevered from the main structural support of the load-bearing stonework of the ground floor. (Dernie, 1995) The facade of this building is divided into two distinct levels. The interface between the bottom layer and the top layer recedes, and the middle layers are cantilevered and protruded from the main load-bearing structure. The inner layer still uses stone as the main constituent element. This part connects the structural framework of the interior theme, and also symbolizes the structural system composed of iron and stone.

In this part of the cantilever, Horta uses large-scale iron structural components. The overall façade is divided into five sections along the vertical direction. They are slightly different in proportions, so this section of the façade still has the characteristic of emphasizing the center,

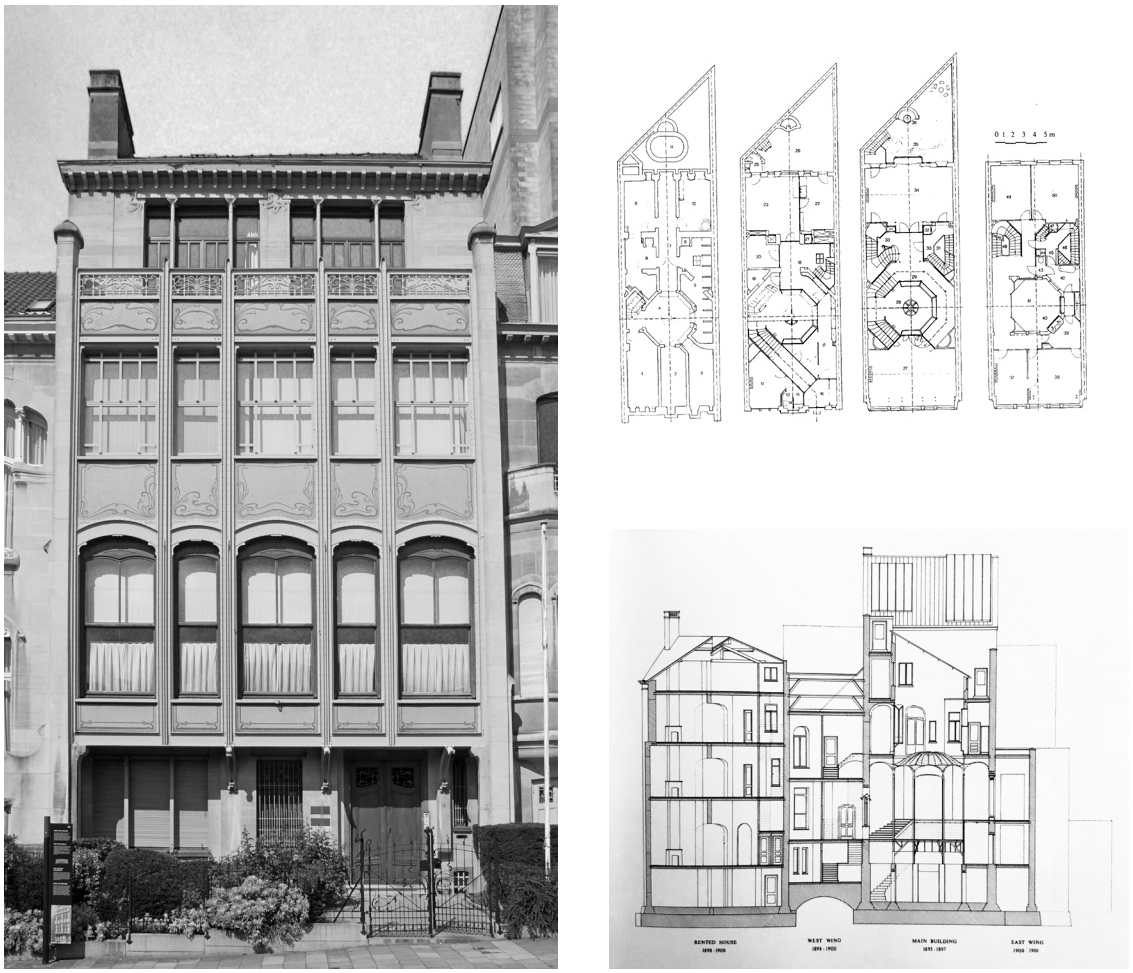


Figure 12-1, 12-2, 12-3. The Van Eetvelde house

rather than a homogeneous plane. In this part, the handling of iron art components becomes more concise. The plant-like texture is basically only reflected in the decoration of the window sill, but it is not easy to notice on the window frame, window hole and structural member. The effect of the overall façade is to increase the level of decoration on the flat surface, but does not make the shape treatment similar to the previous bay window or curved wall on the external shape. For example, the window frame just changes the upper edge of the window frame arched. More vertical dividing lines in the vertical components are emphasized and continue to extend to the third floor where it appears as a loggia-like structure.

Figure 13. The Winter garden

2.2 Spatial Logic Reflection

The winter garden with a glazed canopy is the most outstanding part of this building, and it is also the space where the iron components are the most prominent. The reason for this space is that the owner of this house needs a "a big living room and a dining room as large as you can make", to entertain the guests. (Dernie, 1995) Therefore, Horta made huge changes to the indoor program. He arranged the stairs that were originally located in the center around the center, and naturally enclosing a central space. In this space, the existence of skylights and iron pillars emphasizes the centrality.

The main structure of the greenhouse incorporates a ring of columns within a domed steel structure. (Dernie, 1995) The entire canopy is taken over and unified with the iron components in an extremely dramatic way: the glass dome in the center pours all around, extending down to the circle where the iron structure is located; and when it crosses the boundary of this structure, the shape of the canopy starts to rise again and connects to the surrounding walls and finally ends, forming an arcade-like space. The combination of the central dome and the surrounding arcades makes it easy to think of the traditional central space in classicist architecture. Moreover, the concise and penetrating vertical texture lines on the iron pillars has a metaphor for a Doric column appearance. These classical temperaments show the professional foundation of the classical training that Horta received in the early days. And he conveyed a similar temperament through iron, which is a manifestation of modernism.

2.3 Iron Component Design

Here, the iron material gives full play to its flexible characteristics and constructs a curvilinear structure system existing in three-dimensional space. The vertical pillars rise from the ground, connect to the glass canopy on the top surface, and then expand like two dimensions: one dimension is a ring-shaped extension, and they grow into a circular arch shape on both sides, connecting all the iron pillars that support this space. ; The other dimension is perpendicular to this direction, and a thinner keel extends towards the central space and the outer space to support the glass at the top. Such a free and uniform shape can be realized through the good

extensibility and easy processing of iron. Therefore, the focus of our discussion here is not the decoration or construction of individual iron components, but the way they are connected together. Because the iron here seems to be connected together without any gaps, making it difficult to distinguish between each other.

2.4 Space Atmosphere

In this house, the proportion of green in the interior decoration has greatly increased. In addition, the texture of natural materials is reflected more clearly, such as stone walls. Correspondingly, the iron components are also presented in gray-green color here, which complements various green glass and wall decorations. Revisit the winter garden (fig. 13) in the perspective of color, we will find a wonderful association: green iron pillars rise on the dark green wall, and the color of the structural components in the glass above has changed to yellowish brown. It is precisely here that the iron pillars are distributed on a circular trajectory. The slender pillars are like a number in the jungle, and the glass above is the canopy that they extend out, blocking people's perspective to the sky.

These symbols of nature are regarded as metaphors for the "forest in Congo". (Dernie, 1995) Because Edmond van Eetveldes, the owner of this house, is the secretary of state for the Congo. This can be seen as a response to the identity of the owner. Although it is not clear whether this style comes from the owner's request, or Horta's personal understanding.

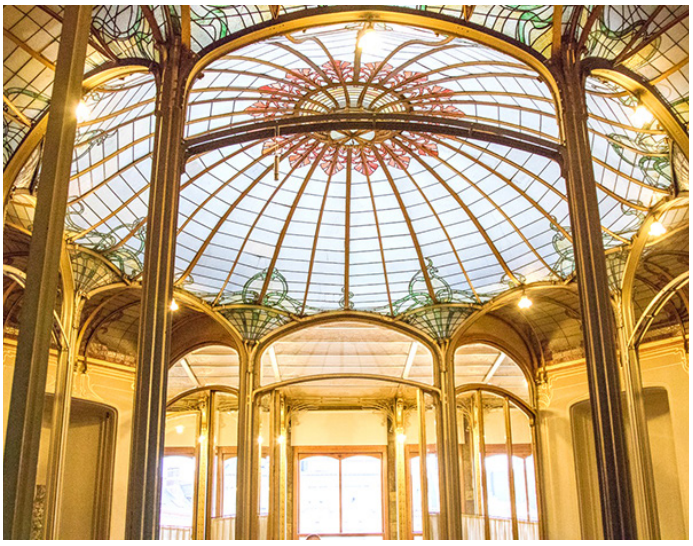
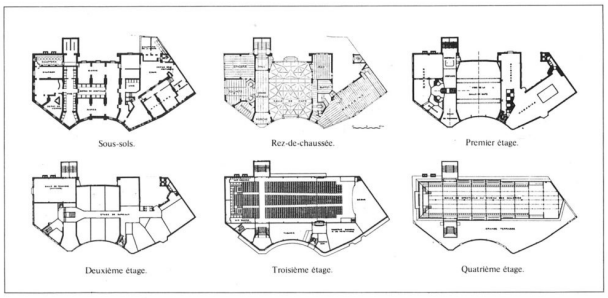


Figure 14-1, 14-2. Interior atmosphere

3. Maison de People, 1896-1899, demolished 1965



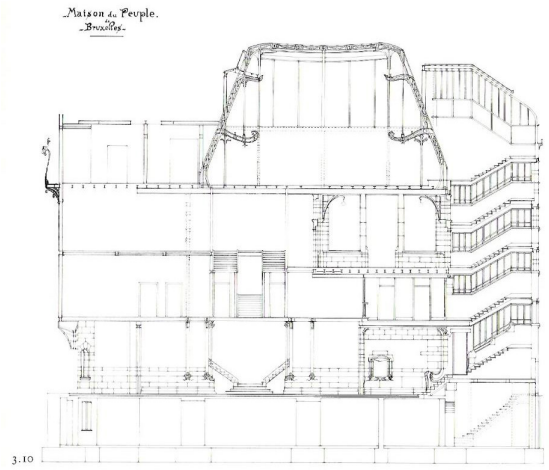


Figure 15-1, 15-2, 15-3. Maison de People

3.1 Main Frontage

Maison de People shows a very different temperament compared with the first two residences. It is not only a public building for the working class, but also has a certain political significance in the era. In this building, Horta discarded many gorgeous and complicated decorative patterns, and instead, try to use iron art to create a new form of public building.

The boundary of the site determines the curved external contour of the building. (fig. 15-1) This irregular shape brings great challenges to the design of the facade: how to create the logic of the building itself and add a regular rhythm to the facade on the irregular shape itself? Here, Horta divides the facade with iron components and forms a new inner order. Long slender columns are used on the facad, which lead directly to the roof from the ground. Some of them broke through the physical outline of the building in the form of flagpoles. This constant repetition of the same components forms an elegant sense of sequence. (fig. 15-2) Let

the whole facade realize a more concise and elegant sense of growth in the dynamic. (Zhang, 2018)

3.2 Spatial Logic Reflection

The iron structure in Maison de People shows more traces of industrial style. From the perspective of structural form alone, the large-span conference hall space uses the truss form commonly used in industrial buildings in order to meet the load-bearing capacity; from the indoor effect, the repeated structural frame also symbolizes a sense of modernity and orderly beauty in standardized production areas. In terms of details, the very prominent rivet elements on the surface of the beams and columns are also strengthening the texture of this industrial era.

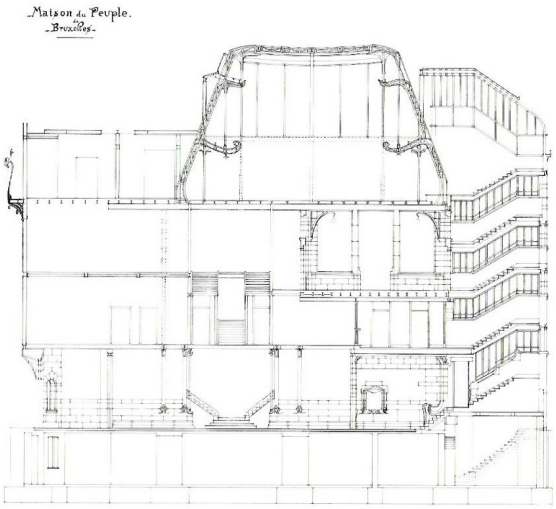


Figure 16. Section of Maison de People

From the section, you can still see the very typical structure of the plant form of Horta. The entire structure forms a large arch to support a large-span indoor column-free space, which spreads out in a curved form at the top and middle, corresponding to the indoor skylight and the auditorium on the second floor. But the real indoor scene is different from his previous works. As you can see in the picture, the interior walls of this space are very pure, with only some straight lines extending at the positions corresponding to the window openings. The same relationship is also reflected in the connection between the structure and the wall. In the past, Horta often extended the lines of the structure to the wall or ceiling to blur the

boundaries between different architectural elements. Here, the truss extends to the side of the skylight and is quickly cut off by the vertical wall. The soft curve structure on the side also leaves a very clear vertical boundary on the wall, forming a sharp contrast between the natural form and the artificial form. Unlike the Art Nouveau interiors, Horta made no attempt to resolve the junction between the wall and the industrial girder overhead. (Dernie, 1995) The operation of wrought iron structure seems to be deliberately to emphasize the difference between the load-bearing structure and the envelope structure in the space, and to make the two independent. This is not only an exploration of aesthetics and visual forms, but also a distinction between different architectural elements, and more abstract relationships are discussed in this opposition.

3.3 Iron Component Design

The entrance of the shop corresponds to a volume protruding outward on the façade. This node embodies a different style from those purely structural tectonic nodes before. Horta simplifies the decoration of iron art as much as possible, using only straight lines. The linear wrought iron elements extending from the upper column are gathered inward in the direction of the ground floor, and then connected to the stone handrail at the entrance. From here, it is not difficult to see the usual structural connection form in his previous works, but in the most simplified form it shows a more abstract connection between architectural elements. In the end, this detail is more concise and sculptural.

Figure 17. Detail of iron jounction

Figure 18. The structure in the cafe

The structural frame of the first floor of the building is adjusted to the shape of each room. Among the more regular functional blocks on both sides, Horta adopts a conventional orthogonal network to organize the structure, and the cafe in the center serves as the center of the first floor space and has also been specially designed in structure. Here the main beam is still along the orthogonal network, dividing the space into three sections in two directions. Secondary steels framed lightly coloured panels and were arranged in a pattern generated by the geometry of an equilateral triangle. This perhaps reflects Viollet-le-Duc's assertion that the essence of nature was represented by a matrix of equilateral triangles. (Dernie, 1995) It looks like the structure on the ceiling is a complete design patter, a background pattern with aesthetic characteristics is laid for the entire cafe space.

3.4 Space Atmosphere

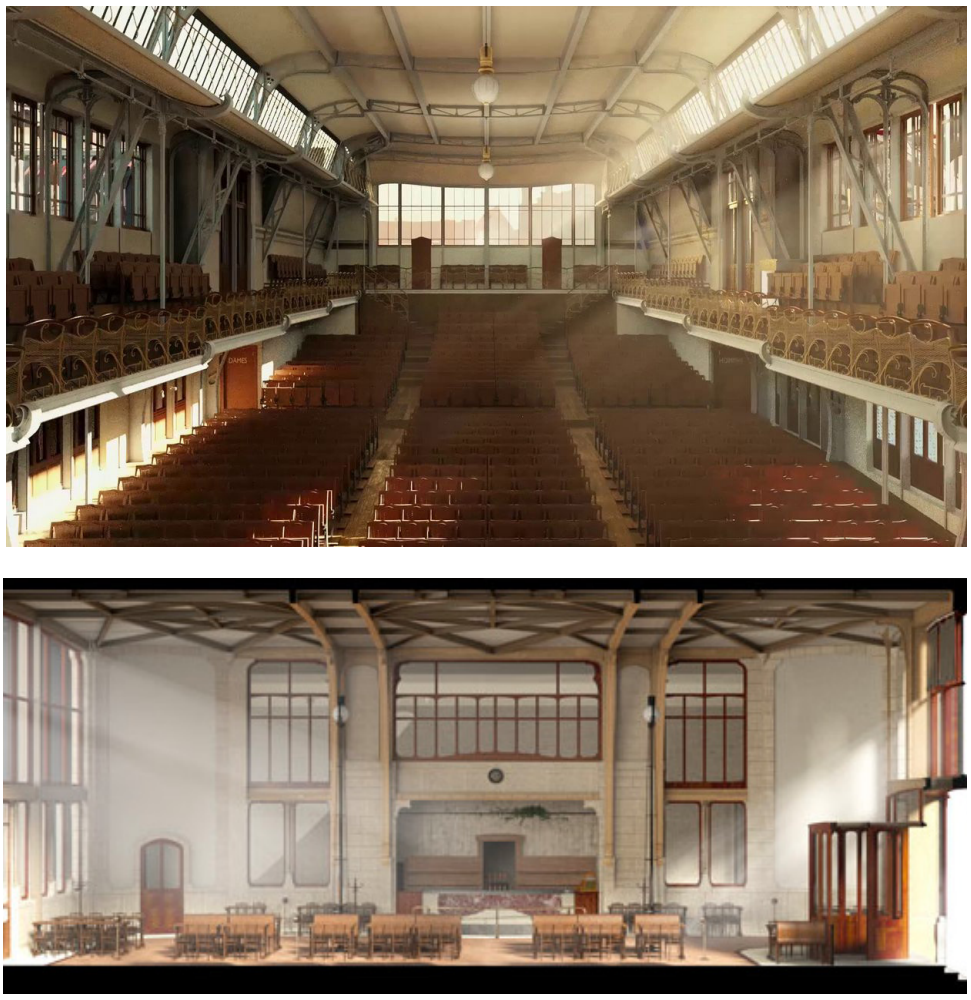


Figure 19-1,19-2. The indoor atmosphere simulated by software

As a public building representing the working class at that time, the space atmosphere of Maison de People has more class symbols. The iron structure here retains a certain degree of industrial atmosphere, instead of trying to weaken this characteristic like in other works of Horta. The iron structure here uses larger-sized components and more exposed details. Coupled with the fact that most of the iron components are painted red, this conflict is even more obvious. These straightforward and powerful expressions seem to promote a kind of antagonism, which comes from the resistance of the structural system to space, and can also represent the resistance of the working class. At the time, this building was also regarded as a symbol of the achievements of the worker class.

Summary of Horta’s Personal Style

The above several cases show some similarities and differences in the design process of Horta's treatment of iron materials.

First, there has always been a natural and organic aesthetic feature in Horta's treatment of iron components. Whether it is private house or public building, the forms of iron art components are not completely deduced from structural rationality. Among them, the aesthetic taste of natural style has played an important role, making Horta start from the natural form and combine the functions of architectural elements to design.

Secondly, the exposure of iron structure and decorative elements is also an obvious feature. In private houses, this exposure can be understood as a sign of open space. Because iron pillars replace the brick walls to carry the load of the house, more space can be connected together. This continuous space and exposed structural columns also bring a kind of exploration of modernity, constantly liberating the basic architectural elements of floor slabs and walls. In the design of Maison de People, this kind of exposure shows a more level of content. Different structural components showed a tendency to break and isolate each other, which seems to be a more abstract design technique. This part will be explained in detail later. What can be seen in

all the cases is that the exposed iron elements have become a way to reflect the characteristics of the building itself through proper arrangement and organization. This new material with the breath of the industrial age has become a status symbol for many new social forces at that time.

On the other hand, there are still many interesting differences among them. In Horta's early works, in the tassel house that is unified as a whole, the existence of the iron component itself reached a perfect harmony. It is perfectly integrated with decoration style and space atmosphere. In Van Eetvelde house, an indoor atrium have a characteristic out of the theme. Here the iron structure becomes a tool to help the special space become more abrupt. The extremely slender iron components and the ever-extending top structure create a forest feel. They are consistent with other spaces in the interior, but the atmosphere of the space is like a pause. Iron materials highlight this difference here. In Maison de People, iron components designed in different ways are more clearly divided. The joint they handed over also more abruptly expressed the difference between elements. For example, the roof truss that was suddenly interrupted by the wall, and the rivets that fixed the beam were completely honestly exposed on the surface of the beam. This difference is not only for the expression of different spaces, but more like a discussion about the relationship between architectural elements. It seems that Horta has gradually changed from his previous method of deliberately blurring the interface and boundaries between different elements to another extreme, which is to use iron materials to express a more "anti-classical" attitude: What form should the architectural elements have? The emergence of iron undoubtedly gave this question a more diverse answer. His work is the practice of this answer.

Charpter 4. Conclusion

This article is a study of the creative expression of iron materials in Horta's architecture. It hopes to use the above content to study how Horta develops the different possibilities of iron materials. And on this basis, further explore how to combine and innovate new materials with the original form of the building.

The industrial product temperament possessed by iron and the symbol of the new era made it a material that was continuously developed in the new architectural trends at Art Nouveau time. Horta has made various attempts to use iron components in his own architectural design. He conformed to the material properties of iron and combined the form of architectural elements, achieving many pioneering material practices. His practice is not simply to reproduce the natural style or follow the rationality of structural mechanics, but should be described as an architectural creation that combines personal aesthetics. In his words, "give life to the forms which poured out of my sensibility". The tendency was to transform external conditions and materials into mental images. (Dernie, 1995)

This tendency is more to serve people's feelings. He broke inherent rules in classical architecture, such as misplaced floors, ambiguous walls, pillars and beams, and created many new forms adapted to the characteristics of iron. Some of these forms start from the space style, some start from the discussion of the identity of the architectural elements. Although the traces of the classical architectural training that Horta received can still be seen from some aspects, such as the balance in proportion, the result of his design shows more of a modern characteristic.

Horta's creative use of iron materials is still of reference value for today's architectural design. There is a balance between classical and modern, as well as a balance between personal aesthetics and functional needs. The design of materials should be combined with the material attributes and the designer's own aesthetic process. How to critically accept existing architectural forms and explore the characteristics of new materials is a topic that architects should continue to think about.

Discussion

In this article, the three most characteristic cases are selected for the research on Horta's personal expression of iron materials. In order to obtain valuable conclusions, there are still some characteristics that are gained by speculation and feeling, and its rationality cannot be determined. If the research object is expanded to more of his works, it may be helpful to improve the final conclusion.

Horta's personal expression of iron takes into account both personal aesthetics and architectural traditions. This combination maintains a delicate balance, which makes his creation both persuasive and creative. In connection with the actual architectural creation process, how to develop and utilize the characteristics of new materials for architectural creation has always been an issue worthy of attention. Because the development of architectural design needs to combine the ideas of people of different eras. If this thesis go further, the balance between this personal expression and traditional architectural forms will be an interesting direction.

Bibliography

Benton, T., & Millikin, S. (1975). Art Nouveau 1890-1902. Open University Press.

Collette, Q., Wouters, I., De Bouw, M., Lauriks, L., & Younes, A. (2010). Victor Horta's Iron Architecture: A Structural Analysis. Advanced Materials Research, 133–134, 373–378. https://doi.org/10.4028/www.scientific.net/amr.133-134.373

Dernie, D. (1995). Victor Horta. academy editions.

Ingold, T. (2009). The textility of making. Cambridge Journal of Economics, 34(1), 91–102. https://doi.org/10.1093/cje/bep042

Kooning, D. M. (1999). Horta and after: 25 masters of modern architecture in Belgium. University of Ghent.

Liang, J. (2020). A Step Towards Modernizatio n of Tow n Houses from a Microscopic Perspective. (2020). Architecture & Culture, 144–145. https://doi.org/10.3969/j.issn.1672-4909.2020.07.044

Swofford, K. (2010). Victor Horta's Vision: Art Nouveau, Fusion of Function and Form. Elements, 6(2), 12–19. https://doi.org/10.6017/eurj.v6i2.9031

Zhang , T. (2018). A Study on the Aesthetic Characteristics of Architectural Forms in Art Nouveau. (2018, May). Tianjin University.