Architecture as “Gesamtkunstwerk” – The Role of the Roof in Defining Architecture in the 19th and 20th Century in Timisoara

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Abstract. Heritage buildings and their surrounding are inseparably intertwined. Anthropological, cultural, symbolic, religious and technical factors are influencing the choice of constructive and architectural features and their interconnection. An important part of heritage buildings, influencing the general outlook, defining its aesthetics, shaping the relationship with the urban context and ultimately contributing to the skyline of the city is the roof. In recent years, numerous timber roof structure assessment methodologies have been developed, which assess the roof structure only by its structural features and state of conservation without taking the link between the roof and the building and its surrounding area into consideration. However, considering the principles of the European guilds, heritage buildings were built with no strict division between symbolic meaning, craftsmanship, architectural aesthetics and urban design methods. This results in a “Gesamtkunstwerk”, a total work of art, with harmonically interlinked features and fully connected to its surrounding, leading to a full aesthetic experience. All these features highly influence the aesthetics of the heritage building but also the shape and height of the roof. During the late 19th century and early 20th century, at the dawn of modern architecture and urban design, a bold and aesthetically conscious use of traditional crafts and methods took place in most European cities - the Arts and Crafts movement, Art Nouveau, National Schools. This study aims to define how the relationship between building, roof and the urban context is changing in Timisoara during the late 19th and early 20th century. Ultimately the main scope of the paper is to identify the role of the roof structure in defining heritage structures built around the beginning of the 20th century through a transdisciplinary and interdisciplinary approach.

1. Introduction
Preliminary studies [1, 2], concerning the history and decline of the guilds, showed that their knowledge had a significant influence on the connection between all crafts and art, all of them accompanied by an array of traditions and symbols.

In the same time, starting from Plato’s regular shapes and ratios, both dynamic (√2, √3 and √5) and sacred (Ф), craft-guilds tried to shape urban spaces and buildings according to their beliefs about God and the universe [3, 4], expressed thru harmonic proportions. This results in complex buildings which present a connection between all their elements, from structure to detail and ornament, a representation of the link between micro and macrocosm, thus creating a total work of art, “Gesamtkunstwerk”.

Since proportional systems are a part of human culture [5, 6], in order to fully identify the value of an historic building, it is necessary not only to examine the building from a structural or architectural/aesthetical point of view, but to look further. Therefore, starting from the believes of the
craft-guilds, and harmonic proportions used to define architecture, important buildings from the historic part of the city, from the main historic squares, were analysed from a multidisciplinary point of view, in order to identify how the use of geometric ratios changed over time and to identify the link between urban space and building from a geometrical point of view (figure 1).

![Figure 1. Geometric ratios in architecture](image)

2. Geometric analysis of the historic squares and buildings

Starting from the historic context of Timisoara, geometry of main historic squares was analysed taking the context of their appearance and development into consideration. Subsequently, further studies have been developed in order to identify how geometric patterns and harmonic ratios are shaping historic buildings from these squares and if they are linked to the proportion identified in the shape of the squares. In the same time, their influence on the choice of roof shape and height were also analysed.

2.1. Historic context

Timisoara is a medium sized city located in the western part of Romania. Its history begins in the 14th century, starting from a small village placed in a slump region between the Timis and Bega rivers. Next to the village a small medieval fortress was built. Due to its good strategic position, between eastern (Ottoman) and western (Hungary, Habsburg, Austria, Austro-Hungary) civilisation the city was conquered and modified over time. After the Ottoman fortress was conquered by the Austrian Empire in the 18th century, the old fortress was torn down and a new Vauban like fortress was built with a rectangular grid of interior streets.

Besides the rectangular grid of the new city, it was also defined by 3 major squares with different purposes and shapes, triangular, square and rectangular: the St. George square, a religious square, the Liberty square with a significant military and administrative purpose and the Union square, with socio-economic functions [7].

2.2. St. George square

In a first phase, two of the main squares were planned in the new fortress, both placed in its southern part. The first one, today known as the St George square, was influenced by the south-west orientation of the former Great Mosque of Timisoara, transformed into a church. This results into a triangular shaped square. The geometric analysis of the square revealed that the resulting shape is a rectangular triangle, in which the ratio between the two catheti a golden ration is. In time, the church was torn down, and the square was transformed into a rectangular shaped one, bordered by two imposing buildings, the Saving House, built at the end of the 19th century and the “Albina” Bank, from the beginning of the 19th century, placed on the position of the former church.
The geometric analysis of the square revealed sophisticated harmonic ratios: two golden rectangles were used, both horizontally and vertically, to define the square. By tracing the diagonals of these rectangles, two Malta crosses were discovered in the two horizontal golden rectangles. The discovery was made during extensive studies for the refurbishing of this square in 1993. The observed geometries are consistent with the fact that this square was dedicated to St. George, patron saint of chivalry orders and patron of Maltese knights [8] (figure 2).

Figure 2. Geometric analysis of the St. George square (18th century plans and current plan)

Despite the fact that the St. George square is one of the oldest one from the city, it completely changed its appearance after the church was demolished and the new building was developed in its former place at the beginning of the 20th century. The new building, built also in the Secession style, presents in this case, a wide array of geometric ratios, from golden ratios, defining the ratio between the roof and the two upper floors, to dynamic ones, which present a link between the first two floors and the roof (figure 3).

In this case, although geometric ratios can be identified on the whole building, no clear geometric approach can be identified since a complex system of different type of ratios was used. Even though the square and the adjacent buildings are influenced by characteristic features of the Maltese knights, the geometric complexity identified while studying the shape of the square could not be found for the adjacent buildings.

Figure 3. Geometric analysis of a building from the St. George square
2.3. Liberty square

The second square, the Liberty square, follows the proposed rectangular grid of the city. Therefore, it had an almost perfect square shape in the proposed plans of the city. The square was dominated by two major buildings, the house of the General of the Army, placed on the southern side of the square, and the city hall, placed on the northern side. In time, the square was extended to the north and is currently also defined by two adjoining golden rectangles (figure 4).

![Figure 4. Geometric analysis of the Liberty square (18th century plans and current plan)](image)

The Liberty square presents a clear aesthetical transition from the 18th century baroque architecture, defined by the former city hall and the aesthetics of buildings developed at the beginning of the 20th century. The baroque buildings of the square, placed on the northern side of the square, present complex geometric principles: dynamic ratios ($\sqrt{2}$) used to define the cornice of the building and golden ratios ($\Phi$) as a ratio between the upper floors and the roof structure (figure 5).

![Figure 5. Geometric analysis of the original buildings of the Liberty square](image)

On the north-wester corner of the square, a Secession building was built at the beginning of the 20th century, replacing a Franciscan order monastery. Characteristic for Secession buildings in Timisoara is the rejection of historicism and interest towards symbolic elements. Therefore, in order to highlight these buildings, imposing towers were placed on the corner and pediments were used to highlight the main facades of the building.
Despite the fact that this building is presenting a different aesthetical approach from the adjacent buildings it still respects their geometric ratios. Therefore, the ratio between the height of the building and the roof at its highest point is (√2), while a golden ratio can be identified as a ratio between the roof at its lowest point and the height of the upper floors (figure 6).

Figure 6. Geometric analysis of Secession buildings of the Liberty square

2.4. Union square
Subsequently, the third and largest square was built in the northern part of the city, the Union square, also significantly influenced by the rectangular grid of the city. The new square was initially planned as a square for the Governor’s Palace, occupying only one block, but since the catholic episcopate was moved to Timisoara, the size of the square was increased, and a catholic cathedral was also included in the eastern frontage of the square, without forming a continuous front with the adjacent buildings. The geometric analysis of the shape of the square, revealed that it is almost a √2 rectangle, defined by the frontage of the buildings (figure 7).

Figure 7. Geometric analysis of the Union square (18th century plans and current plan)

The geometric analysis of the buildings from the northern side of the square, which are the only buildings which kept their original appearance through time, showed a consistent use of same principles in defining key aesthetic elements of the building and a clear geometric connection between all elements. Therefore, these buildings which were developed in the early stages of the square, present a clear use of golden ratios in defining the height of the roof compared to the total height of the building. In the same time, for the original buildings, with only one upper floor, the ratio between the height of the roof and of the upper floor is also Φ (figure 8).
On the western and southern side of the square, the height of the buildings was increased in time, therefore slightly changing the proportions of these buildings. Therefore, used ratios change for these buildings from sacred ratios ($\Phi$) to dynamic ones ($\sqrt{2}$) defining both the ratio between the total height of the building and the height of the roof, as well as the ratio between the upper floors and the roof (Figure 4). Despite to the fact that the proportion is changing, the key points in defining those ratios are the same key architectural and ornamental elements (figure 9).

2.5. Victory square
At the beginning of the 19th century, because the fortification was preventing the old city from developing, the decision to demolish the fortress was taken and various new urban planning proposals were made in order to ensure the connection between the old city and the close by towns, which would become neighbourhoods of the new city. The final project, proposed by architect Ludwig von Ybl and
engineer Aladar Kovacs Sebestyen proposed radial and circular streets which could ensure a proper connection between all the future neighbourhoods of the city. In the same time a new square was proposed with a rather socio-cultural purpose, the Victory square. Compared to the historic Liberty and Union square, which are rectangular, the shape of the Victory square is more complex, being an intersection between an elongated rectangle with a strong north-south axis and a secondary axis ensuring a visual link between the main square and the area placed in front of the old medieval castle. The geometric analysis of the square in the original plans, supposed a complex sequence of ratios, which would define the position of transversal streets compared to the width of the square, using dynamic (√2) ratios. The geometric analysis of the current square, showed also a clear harmonic rhythm, although completely different from the original one, along the main axis of the square, 1-1-√2-√3, defined by the shape of the buildings and by secondary streets placed perpendicular to the square. In the northern part of the square, the buildings form a semi-circular space pointing directly towards the castle (figure 10).

Figure 10. Geometric analysis of the St. George square (18th century plans and current plan)

The buildings in the Opera square on the other hand are a clear example on how the aesthetics of the buildings changed at the beginning of the 20th century. Since the aesthetic of the time encouraged the use of monumental buildings with imposing roofs, meant to define urban space and mark the new urban square, roofs in this case tend to be rather linked to the height of the whole building than to only a part of it, like in the other square.

Two buildings, placed at the intersection between the two axes of the square were analyzed, buildings which have a double purpose, to define the continuous front of the elongated square and to define the secondary axis towards the castle, the Lloyd and the Lőfler palace, both built at the beginning of the 20th century.

The Lloyd palace due to its position, has a complex roof, built using different types of roof shapes from pyramidal to gable roofs according to their position towards the public space. Therefore, distinct types of ratios were identified for all different height of the roof. On the one hand the gable roof placed on the side of the buildings towards the square, is linked to the height of the building through a √3 ratio. The main pyramidal roof on the other hand represents at its highest point 1/3 of the total height of the building. The corners of the building, having a lower roof, are defined by a 1/6 ratio compared to the height of the building (figure 11).
The Löfler palace has also a complex roof, composed of roof shapes with different heights according to their context. Like in the case of the Lloyd palace, different types of ratios were identified for the pitch of these roofs. The geometric analysis showed that the ratio between the highest point of the roof and the height of the building is in this case static (1/3). The same point on the other hand compared to the upper floors of the building presented a $\sqrt{3}$ ratio, which present a different geometrical approach than the one used for the Lloyd palace. The same $\sqrt{3}$ ratio was also identified as a ratio between the lowest pitch of the roof and the total height of the building (figure 12).

3. Results and discussions
The study of geometric ratios used to define historic buildings in the centre of Timisoara strengthened the hypothesis of the research team and brought forward that geometric ratios (sacred, dynamic and static), were used in all buildings until the beginning of the 20th century.

In the same time, the analysis showed that harmonic principles suffer a notable change at the beginning of the 20th century. Until the end of the 19th century, roofs were shaped in a close relationship to buildings as well as to important ornamental elements. Used harmonic ratios are in this period sacred ($\Phi$) or dynamic ($\sqrt{2}$).

After the 1900, due to the raising importance of the roof in defining urban space, the ratios between building and roof changes. In this period, no clear use of a certain harmonic proportion can be identified.
anymore, the ratios ranging from sacred ($\Phi$) to static ($1/3, 1/6$), influenced by the way the building can be perceived.

4. Conclusion

The study presents a first attempt to identify harmonic ratios in Timisoara and to find a geometric link between the shape of the square and the proportion of building and roof.

In the historic part of the city, because of the rectangular grid of streets, only important buildings, mainly religious and administrative buildings, have a high visibility and can be perceived from far away. Proportional systems can therefore only be assessed for buildings in the main historic squares and roof can therefore only be perceived in these squares.

Architecture principles change significantly at the beginning of the 20th century, giving the link between proportional systems and architecture up. The most important feature defining architecture in this period is the way buildings shape urban space and how they are perceived. Architecture becomes more expressive, simple functions, like housing, become impressive buildings in a close relationship to the surrounding urban space. New urban planning principles, offer different ways of perceiving buildings, even from bigger distances which ultimately affects the scale and shape of buildings and the ratio between building and roof. Roofs become therefore the main aesthetic and expressive feature.

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