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Semiotics of Architectural Ornament

A Method of Analysis

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Summary

This paper presents a method of analysing architectural form developed within the larger framework of research dealing with ornament as a means of identification and of space appropriation[1]. The method is demonstrated by a specific application to residential façades. It consists of a modelling procedure based on linear graph and symmetry groups, which decomposes architectural forms into generic motives and shows their combinatorial principles in the case of the façades taken into consideration. Analysis leads to the identification of a syntactic code and of various means of individualization of the façades. A brief conclusion proposes further developments and applications of the method.

Résumé

L'article décrit une méthode d'analyse de formes architecturales développée dans le cadre d'une recherche sur l'ornement comme mode d'identification et d'appropriation spatiale[1]. L'analyse emploie des graphes linéaires et des groupes de symétrie. L'étude de façades résidentielles permet la décomposition des éléments architecturaux en motifs génériques et définit les principes de leur composition. L'analyse conduit à la définition d'un code syntaxique et identifie divers procédés d'individualisation employés pour les façades. La conclusion de l'article indique des possibilités d'élaboration et d'autres applications de la méthode.

1. Introduction

Architectural ornament has often been defined as gratuitous addition to functional form. Upon close examination however, this raises two problems. On the one hand, ornament plays an important role in enhancing the visual efficiency of buildings and in articulating their meaning; as such, it fulfils aesthetic and social functions no less important than utilitarian ones. On the other hand, it is impossible to draw a clear line between the necessary forms of an object and the merely ornamental ones; for example, the configuration of a window – its proportions, the articulation of its components, details and colours – is superfluous as regards the

1. A. Ligougne, T. Nakajima and the author collaborated on this research which is supported by a grant from the Ministère de l'Education du Québec. Illustrations were done by Yvan Breton.

performance of its primary functions. In that sense, ornament underlies all architectural forms and cannot be artificially isolated.

The nature of ornament is especially meaningful in residential façades, because as interface between the private and public domains, it plays a major role in conveying the content of a "way of inhabiting". It is thus a key to architectural semiotics. These façades form an expressive system related to social and cultural codes within which collective and individual communicative acts can be articulated.

Defined as rules, or conventions, according to which signifying units are attached to signified ones, such semantic codes have been the subject of numerous studies conducted mainly by architectural historians and critics (Brandi, 1967; De Fusco, 1967; Eco, 1968; Gamberini, 1953 and 1963; Gandelsonas, 1972; Jencks, 1969; Scalvini, 1972; Koenig, 1964). In terms of Hjelmslev's model of the sign as an entity divided into a level of expression and a level of content, these studies focus on the level content. They deal with segmented architectural components and their semantic markers, the latter constituting signs of another type, such as verbal ones, thus leading to an indefinite semiosis (Eco, 1972).

An alternative approach to architectural semiotics is to explore the codes which underlie the composition of signifiers within the architectural object, or the spatial codes. Such a morphological approach is based on the contention that in architecture there cannot exist a one-to-one correspondence between units of expression and units of content. Architectural space has its own specific structure and the relationship of this structure to social and cultural content is of an interactive nature. In contrast to the highly complex and variable nature of the relation between signifiers and signified, the expression of architecture can be considered as a relatively closed system, thus lending itself to formal analysis (Boudon, 1972 and 1981; Castex and Panerai, 1979; Hammad *et al.*, 1973; Ostrowetsky and Bordreuil, 1980; Provoost, 1974).

The present study will show that it is possible to formalize the operations leading to architectural expression and that they form a closed system. Strictly speaking, it is concerned with the morphological structure of residential façades, their common code and the means through which individual houses are differentiated and identified, but it will also be shown that the method put forward uncovers general principles pertaining to the form of expression which condition the proper meaning of architectural statements independently of all references to social, cultural or behavioral systems.

2. The Sample

The test sample of residential façades was selected in a socially and architecturally homogenous environment. It consists of a block of thirty-one houses limited by two avenues and two streets in an urban neighbourhood in Quebec City. The sector contains some twenty similar blocks of three-floor apartment buildings. About a third of the ground floors of these buildings are occupied by commercial services, especially on street corners and along avenues. The majority of the houses within this neighbourhood were built during the twenties and early thirties by small building firms. Many of their formal characteristics can be attributed to building regulations as well as to the craftsmanship of the local builders (Fig. 1).

A photographic survey recorded each façade and its details. Further data such as the colours of the various building components, their materials, their distance from the property line and their state of maintenance where also recorded.[2]

Fig. 1. Street façades of the sample block.

3. Theoretical Approach and Methodological Context

The method of analysis presented in this paper is based on the fact that architectural form can be viewed as a complex ornament. As such it constitutes a set of generic forms analogous to ornamental motifs, to which a set of combinatorial rules is applied. This characteristic of architectural form is due to several factors inherent to the process of conception and realization, such as programmatic requirements, aesthetic intentions, structural constraints and economic and technical considerations, all of which tend to favour the repetition of parts within the architectural whole. For this reason, architectural forms can be modelled by the theory of symmetry groups. The application of symmetry groups to the analysis of ornament has long been demonstrated by mathematicians like Shubnikov (1974), Speiser (1945) and Weyl (1952). They have likewise been applied to the analysis of architectural plans (March and Steadman, 1971) and even to the generation of networks for architectural planning and design (Neumann, 1975).

In brief, symmetry is the property of geometric figures of repeating their parts, or their property of coinciding with their original position when in different positions (Shubnikov, 1974). A symmetry operation is a displacement, or a reflection which transforms a figure into itself, for example, a 120° rotation applied to an equilateral triangle (Fig. 2). A set of operations forms a group if it contains an identity operation, the inverse of each and the product of any two of its operations. The order of a group is defined as the number of distinct operations it contains. In the example of the equilateral triangle the order of the group is six, because it contains three distinct rotations and the products of each of these rotations with a reflection, a product being the successive application of operations. A symmetric figure is thus generated by a group of operations applied to a motif which constitutes the basic

2. Many data, useful for other parts of our study on ornament and space appropriation, are not used in the formal analysis which is the object of the present paper.

asymmetric component of that figure (see shaded area in Fig. 2). Detailed definitions, descriptions and enumerations of the plane and space symmetry groups are given by Coxeter (1961), Nicolle (1950) and Tôth (1964), as well as in most introductions to crystallography.

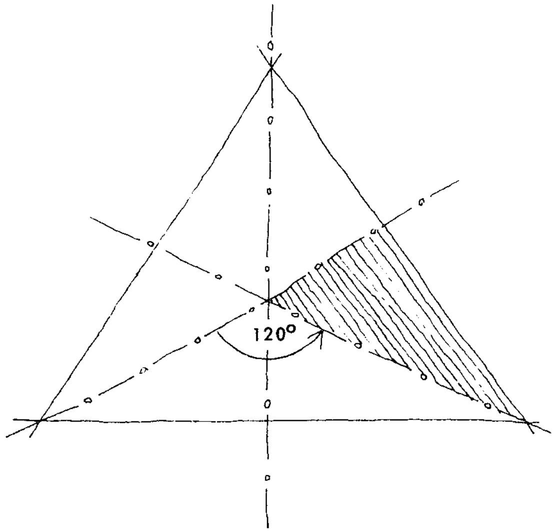

Fig. 2. An equilateral triangle generated by three-fold rotations and mirror-reflections.

While architectural components (doors, windows, etc.) can be decomposed into their generic motifs, they themselves constitute motifs in the composition of the entire façade. Façades, however, have a higher degree of complexity than simple geometric figures. This is due to the interlocking levels of scale as well as to the often subtle and ambiguous interference of unrelated patterns within the same architectural composition. These specific and complex characteristics can be modelled through linear graph which can represent adequately the interrelationship between the symmetry groups identified. For our model, the graph vertices can represent groups of symmetry while its edges can represent the relationship between any two groups; for example, concordance between two groups can be indicated by a linking edge, and the absence of an edge denotes a relationship of interference between two patterns. A graph can also be divided into subgraphs containing subsets of its vertices. For our purpose vertices representing groups of symmetry can be grouped into subsets according to the level of scale to which they relate. Such a combination of symmetry groups and linear graph becomes an operational tool for modelling façades.

4. Modelling Procedure

The analysis of expression calls for the definition of discrete invariant units which compose the architectural space and whose characteristic configurations can be systematically modelled. In the present study, these units are termed "elements" and defined as façade components which retain their original meaning (denotation) when isolated from their context, as in the case of the cornice, the wall, the windows, the doors, etc. With reference to Hjelmslev's model which divides each level of the sign into form and substance, we define the substance of expression as the specific geometric configurations of the architectural elements, and the form of expression as the combinatorial rules which compose the façade. Both the substance and the form of architectural elements can thus be coded by symmetry groups, while the structure of an entire façade can be modelled by linear graph. This linear graph consists of two subgraphs: an "upper" subgraph which models the spatial composition of the elements within the façade and a "lower" subgraph which codes the motif combinations of each element.

4.1. The Upper Subgraph

The upper subgraph consists of labelled vertices representing elements as well as symmetry groups, and of edges representing relationships between symmetry groups and elements. Vertices are arranged on three distinct scales (subgraphs): the first scale contains symmetry groups pertaining to the composition of the entire façade; the second contains groups which compose the patterns of each element; and the third scale contains the elements themselves. The following example demonstrates the hierarchization of vertices and the procedure of linking them with edges. The façade in Fig. 3 is modelled by the graph in Fig. 4, where the vertex D_1 on the first scale represents the bilateral group of symmetry whose motif consists of half the façade (vertical shading in Fig. 3). The vertex F_2^2 on the second scale denotes a "frieze" group consisting of translations and perpendicular reflections, which composes the window elements (diagonal shading shows the window motif). In this example, the bilateral axis of the entire façade coincides with the axis of the cornice

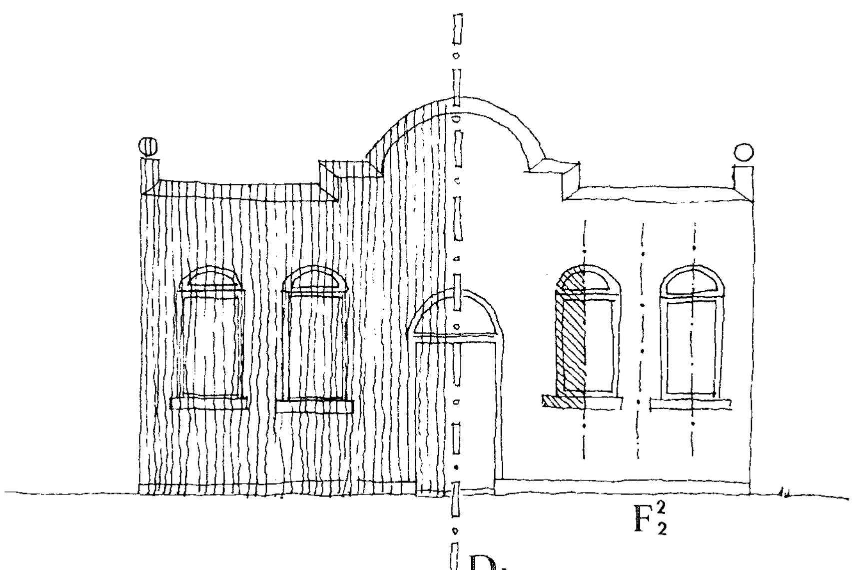

Fig. 3. A façade showing an overall bilateral symmetry group (D_1), with a window pattern generated by translations and perpendicular reflections (group F_2^2).

and door elements and therefore these elements are directly connected to vertex D_1 on scale I. However, the motive of D_1, or half the façade, contains the pattern of windows generated by F_2^2. Thus the window element is connected to the vertex F_2^2, on scale II. One may consider the window pattern to be generated by two successive sets of operations: first by the frieze group F_2^2, and subsequently by D_1. Therefore vertex F_2^2 is also connected by an edge to vertex D_1.

In the façade of Fig. 3 the composition of all elements is in conformity with the overall bilateral design, and as such it exemplifies a simple case. We shall now consider the coding of more complex cases, such as façades with more than one overall symmetry group on scale I, or with no overall symmetry group, and façades with dissymmetrically positioned elements.

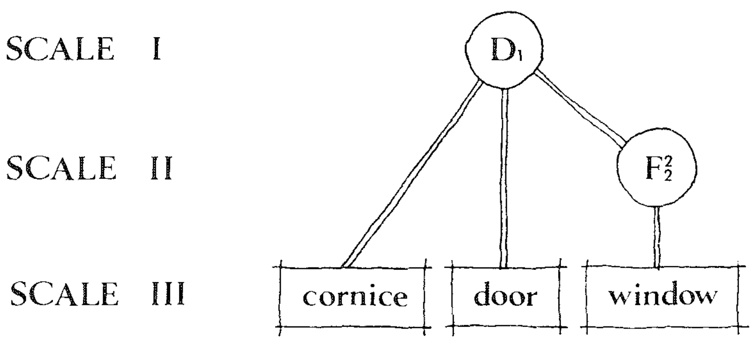

Fig. 4. The graph model of the façade in Fig. 3.

4.1.1. The Coding of Scale I

The coding of the first scale implies two basic problems. First, it is necessary to define under what conditions a façade can be considered to have an overall symmetry group. In the sample of houses studied here, the cornice is one of the most ubiquitous elements and because it limits space vertically and also defines the width of each individual house, it is considered a major element in determining the overall symmetry group of the façade. In the absence of a symmetric cornice, the façade is considered symmetric only if at least two distinct elements, such as doors and windows, are distributed by the same symmetry group or by related symmetry groups (groups and their subgroups). A façade lacking a symmetric cornice or a minimum of two related element patterns does not have an overall symmetry group on scale I, and can be said to possess only one operation, namely the identity.

The second problem related to scale I concerns the existence of two or more simultaneous groups determining the symmetry of the entire façade. The façade shown in Fig. 5 has bilateral symmetry (D_1) on scale I whose motif is half a façade (vertical shading). However, the façade can likewise be generated by group F_1^1 whose motif, constitutes half a floor elevation (diagonal shading). F_1^1 is a frieze group which consists of translations and a parallel reflection. In this example, the reflection axis of F_1^1 coincides with D_1. The graph of this façade takes the form shown in Fig. 6. Considering that the motif of D_1 contains the pattern of F_1^1, vertex D_1 precedes vertex F_1^1 on scale I. The two groups being related (D_1 is a subgroup of

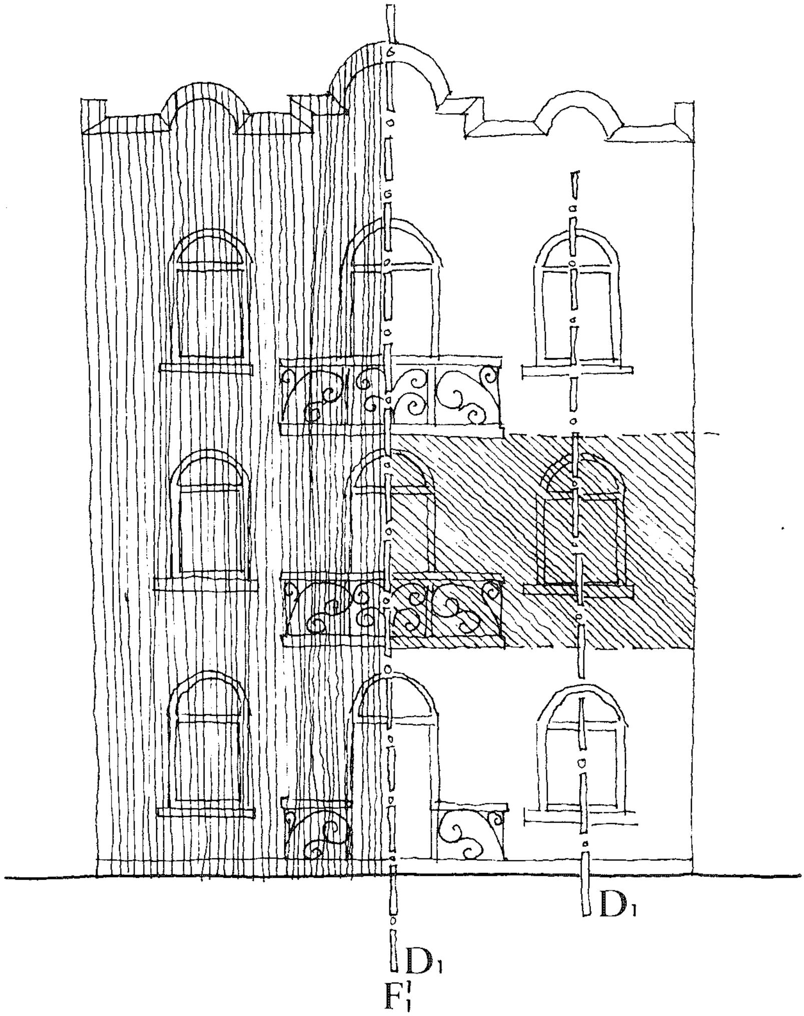

Fig. 5. A façade showing on overall bilateral symmetry (D_1), as well as the symmetry of group F_1^1 consisting of translations and a parallel reflection, the reflection axes of both groups coinciding. The window pattern has its own axis of bilateral symmetry (D_1).

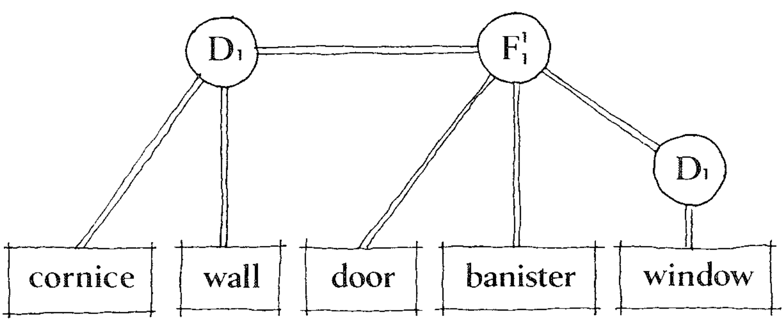

Fig. 6. Graph model of the façade in Fig. 5.

F^1_1), they are connected by an edge. Elements are connected by an edge to vertex D_1 or F^1_1 according to whether they are merely reflected as in the cornice, or reflected as well as translated as in the case of the doors. The window pattern, however, though generated by group F^1_1, is not located on its reflection axis as are the doors and balustrades. Therefore, the window element has its own group of symmetry D_1 on scale II whose axis is shown in Fig. 5. The coding of scale I is thus based on the relative size of the motifs, or the repetitive units of the symmetry groups pertaining to the entire façade. The coding of scale II allows the distinction between elements whose symmetry operators (i.e. axis of reflection) coincide with operators of groups on scale I and those with operators located elsewhere in the façade.

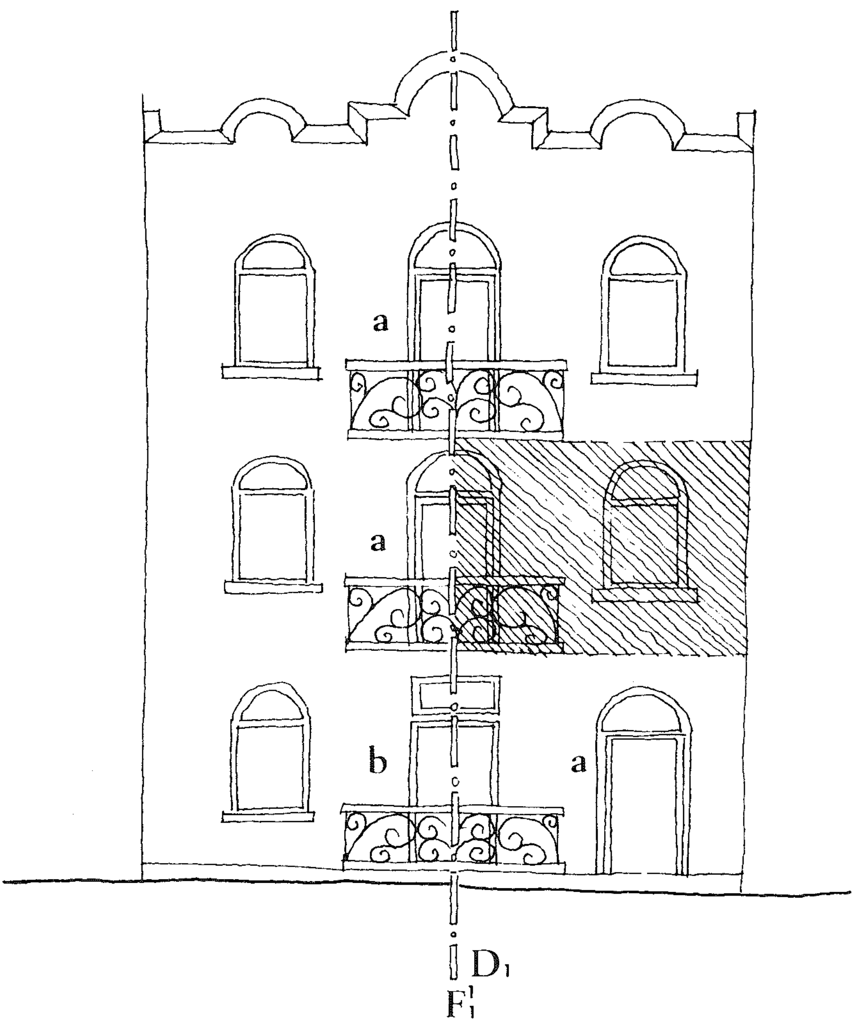

Fig. 7. A façade with dissymmetric and asymmetric door elements. D_1 denoted bilateral symmetry and F^1_1 the symmetry group generated by translations and a parallel reflection. The motif of group F^1_1 is shown by the shaded area.

4.1.2. The Coding of Dissymmetry

Architectural elements are very rarely asymmetric, or totally devoid of symmetry. However, an element may be dissymmetric in relation to a given reflection axis, or it may be dissymmetric in relation to a translation or to a rotation. In order to differentiate between these two cases, the latter will be termed asymmetric. These two possibilities are shown in Fig. 7, where door *a* is dissymmetric in relation to the reflection axis of F_1^1 and door *b*, while reflected in the axis, differs formally from the repetitive door elements on the upper floors and is thus asymmetric in relation to the translation vector of F_1^1.

The problem of coding asymmetries and dissymmetries in the graph is resolved by introducing two types of links between vertices: arcs (directed edges) and simple edges. The former serve to code symmetric conformity between two vertices while the latter denote asymmetric and dissymmetric relationships. By convention, arcs are always directed towards lower scales. The further distinction between asymmetries and dissymmetries is achieved through the procedure demonstrated in Fig. 8. In this graph which models the façade in Fig. 7, door *a* is twice connected to vertex F_1^1: once by an arc denoting doors *a* located on the axis and generated by the group F_1^1, and once by the interposition of a vertex D_1 on scale II which is the proper group of the dissymmetric door *a* on the ground floor. The simple edge linking the vertex D_1 on scale II and vertex F_1^1 on scale I signifies that their operators, in this case the two reflection axes, do not coincide. This simple edge differentiates the coding of the dissymmetrically located door *a* from the coding of the window element. For although the window element is not located on the axis of F_1^1 it is nevertheless generated (reflected and translated) by it. Thus vertex D_1 of the window element on scale II is connected by an arc to vertex F_1^1. Finally, the asymmetric door *b* is directly connected by a simple edge to vertex F_1^1 denoting that it is located on the axis but not generated by the translations of group F_1^1. With this coding, the graph model can incorporate the distinction between formal and locational singularities of the façade elements. The partial modelling of a façade chosen from our study sample (Fig. 9 and 10) into an upper subgraph shows the relevance of graphs for modelling both the formal and locational singularities of the façade's elements.

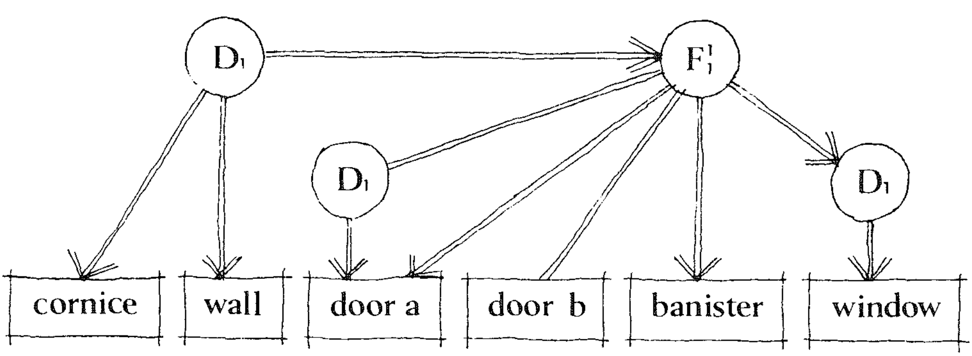

Fig. 8. Graph model of the façade in Fig. 7.

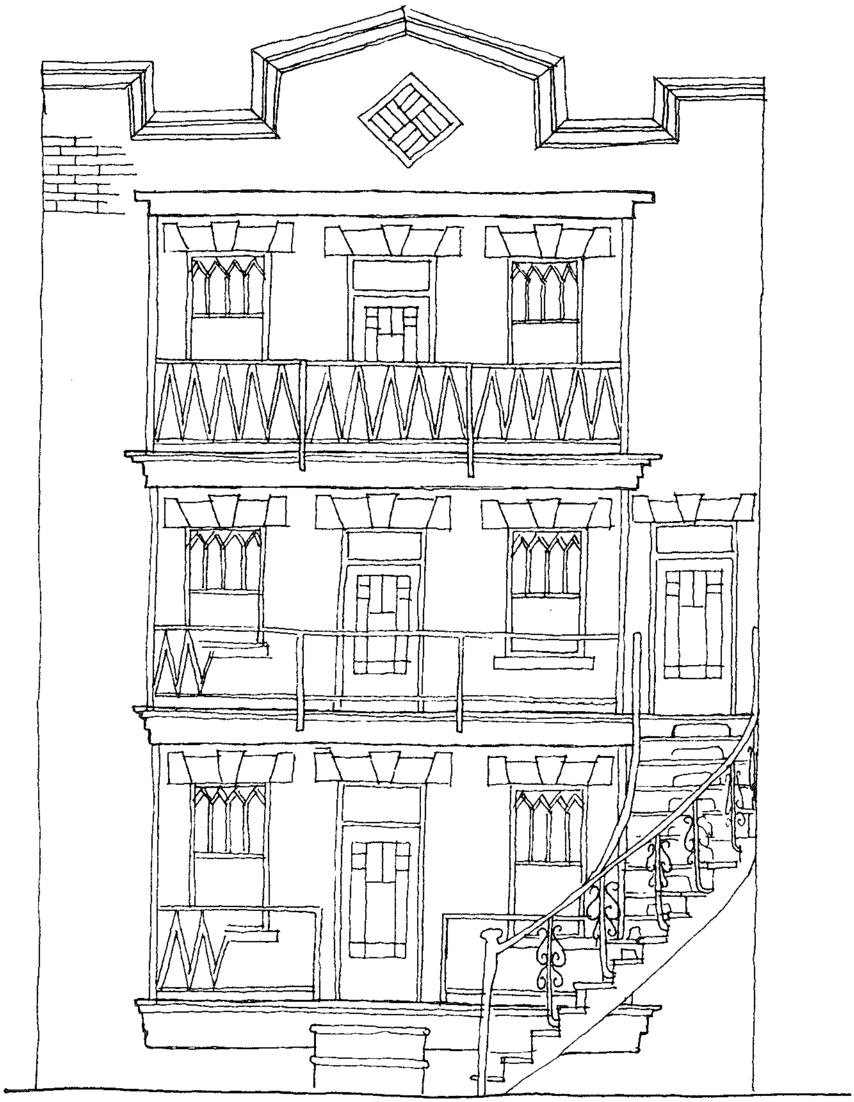

Fig. 9. A façade from the study sample.

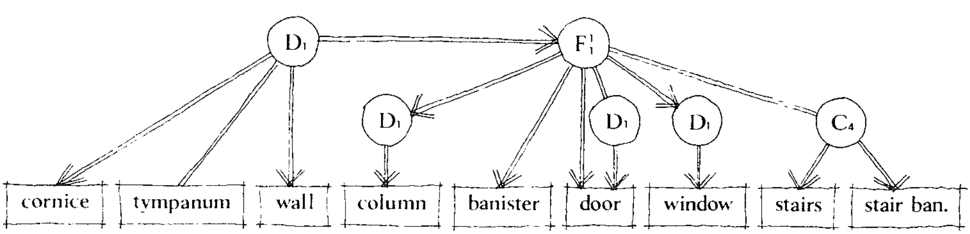

Fig. 10. Graph model of the façade in Fig. 9. The asymmetric staircase is generated by a rotation and perpendicular translation, but is coded only by its four-fold rotation group (C4).

4.2. The Lower Subgraph

In contrast to the upper subgraph which models the combinatorial relations of elements in the façade, the lower subgraphs represent the actual formal substance of each element. The vertices of the lower subgraphs are disposed according to three levels corresponding to motifs, limiting-motifs and sub-motifs. Motifs are defined as the outer contours of an element, such as door frames, supporting matrix of a bannister, etc. Limiting-motifs correspond to sub-elements which do not constitute essential parts of an element, but which only occur in conjunction with it, for example lintels, framing borders of tympana, etc. Sub-motifs are the smaller scale patterns which articulate motifs and limiting-motifs. Fig. 11 illustrates two

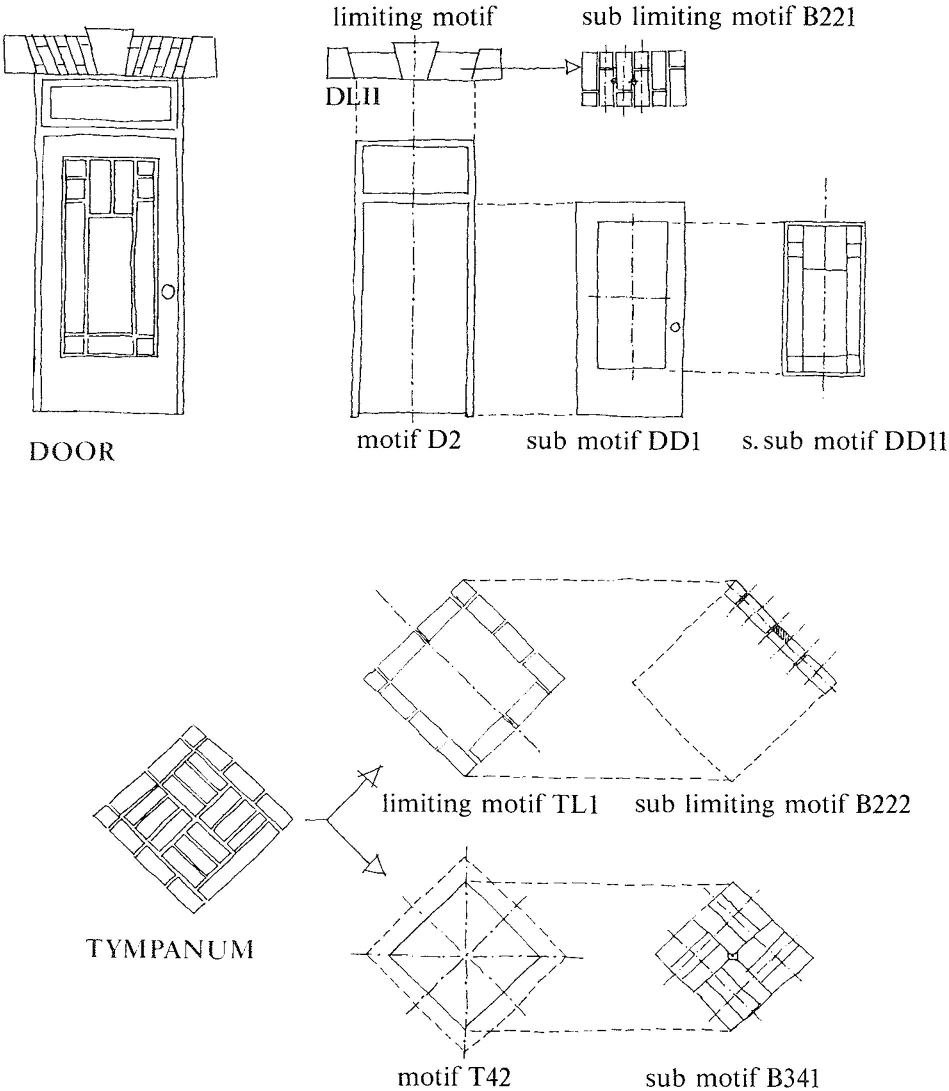

Fig. 11. The decomposition of architectural elements into motifs, limiting motifs and sub-motifs.

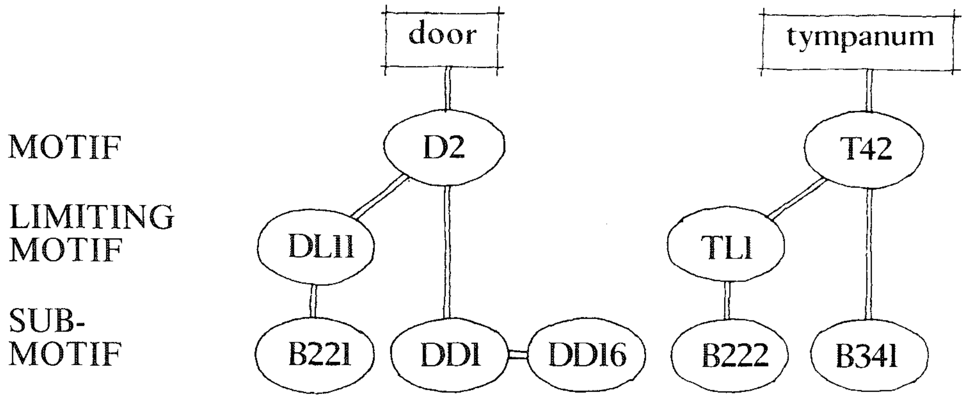

Fig. 12. Sub-graphs of the door and tympanum elements shown in Fig. 11.

elements and their decomposition into motifs, limiting-motifs and sub-motifs. Motifs, limiting-motifs and sub-motifs of all elements are listed and coded in the following manner: for each element all occurring motifs are listed and classified according to the symmetry operators they contain. Within each category each motif is further identified by its specific generic configuration. Thus the code of each motif as shown in Fig. 11 consists of a letter designating the element to which the motif belongs such as "T" for tympanum; a number referring to the number of symmetry operators the motif contains, for example, "4" for four reflection axes in the tympanum motif; and finally, a number which identifies the specific generic configuration of the motif.

The same coding method is applied to limiting-motifs and sub-motifs. However, certain sub-motifs do not belong to any specific element and are therefore coded by a separate letter, such as brick patterns which occur in tympana, friezes, walls and lintels and are coded by the letter "B". Fig. 12 shows the lower subgraphs for the door and tympanum in Fig. 11. Limiting-motifs and sub-motifs are connected by edges to motifs which they articulate.

This procedure decomposes elements into their constituent motifs. Elements can thereby be compared in terms of the number of formal variations characterizing each.

An alternative coding method consists of labelling all motifs, limiting-motifs and sub-motifs with the symmetry groups which generate them. This simplified coding procedure neglects the specific data of each motif's configuration, but presents the advantage of a uniform coding system. It allows comparison of motifs, limiting-motifs and sub-motifs across all elements, as well as the identification of characteristic symmetry groups for each element.

5. Analysis of Lexical and Syntactic Aspects of Residential Façades

The modelling procedure described above has the advantage of presenting the formal characteristics of the architectural elements as paradigms of variations, as well as the entire façade context within which they are embedded. Besides the simultaneous occurrence of elements within the same façade, the graph also codes their relative spatial positions. It is thus possible to analyse the lexical repertory of each element, the syntagmatic distinction between elements as well as their eventual grammar, or syntactic codification within the façade.

Once all façades are modelled, their graphs are grouped by streets and converted into sets of three-dimensional matrices. The analysis can then proceed with compiling the frequencies of elements and of element combinations within the façades. In the sample studied, the total number of elements was twenty-nine with an average of eleven elements per façade. Of these twenty-nine elements only thirteen were distinct elements, or element categories, the remainder being variations of the former, such as differently styled doors or windows within the same façade (labelled door *b* and *c*, etc.). The most frequent combination of elements coinciding within the majority of façades was found to consist of only seven elements listed in Table 1. These can be termed "common" as opposed to the remaining six "rare" elements.

Next, the upper subgraphs are broken down into chains, linking elements to the overall symmetry of the façade. All elements and their respective chains are then listed in rank order according to their frequencies. The resulting table indicates the common vocabulary of elements as well as their common syntax, or rules of combination in the façades studied. It also points at unusual chains which, together with the rare elements, are assumed to constitute means through which houses are identified and individualized. Even such a gross compilation is very suggestive as to the nature of the architectural expression.

As for the chains and their study in our sample, it was found that out of a total of fifty-six distinct chains only fourteen had a high frequency of occurrence for common elements, and of these only four were exclusive to these elements. In other words, these chains did not occur with rare elements. In contrast, the percentage of unusual chains exclusive to common elements was higher than that of chains exclusive to rare elements. This seems to indicate that the introduction of rare elements in the façade is a sufficient expression of individuality within the studied environment, and that the addition of unusual combinatorial patterns to these elements is considered useless because it would constitute redundant information. It was also found that the distribution of the unusual chains and of the rare elements within the studied block of houses revealed a significant difference between the façades located on streets and those located on avenues, the latter having twice as many rare elements and unusual chains of combinations as the former. In contrast to the residential streets, houses on avenues were mostly designed to accommodate shops on their ground floors and this commercial function seems to have prompted a greater degree of individual distinctions between neighbouring façades. In other words, public functions favour more blatant means of identification than private ones.

The next step consists of compiling the number of motifs, limiting-motifs and sub-motifs for each element. Column 1 in Table 1 shows the sum of distinct combinations of motifs and sub-motifs for each element in the studied sample. Column 2 shows their respective number of occurrence and column 3 the number of façades in which they occur. Column 4 reports an index of variability for each element which has the form of a ratio between the sum of different combinations and their total number of occurrence. Of the seven current elements, only three – cornice, bannister and window – show a high index of variability, that is to say, the highest degree of formal variations which differentiate one façade from another, thus individualizing each house.

Further examination of these elements (Table 1) shows that the cornice has a large number of motifs and few sub-motifs, the window possesses approximately an equal number of both and the bannister has a much greater variety of sub-motifs than motifs. Such distinctions between elements do not seem to be a random result. On the contrary, they happen to coincide with two other spatial attributes of the elements. First, the three elements are each located on different spatial boundaries: the cornice underlines the vertical boundary between the building and the sky; the bannister is located on the limit between the public and private exterior spaces; and finally, the window marks the interface between the private inside and the public outside spaces. Second, the three most varied elements pertain to three different perceptual scales: the cornice is always viewed from a fixed distance; therefore, its articulation with fine patterns would be of small perceptual significance. Windows, however, can be viewed within two distinct ranges – both sides of the street. Their motifs dominate from a greater distance, while their finely patterned sub-motifs, such as the articulation of their sashframes, becomes noticeable upon approaching the façade. Finally, bannisters having a small number of motifs but the largest number of sub-motifs (some on a very fine scale) seem to be designed to create an impression of formal unity from a distance, of variety from a shorter distance and finally of great richness of detail at direct manipulation distance.

Table 1. Common and rare elements, their number of motifs, limiting, and sub-motifs.
Column 1 *shows the number of motif combinations for each element.*
Column 2 *shows the frequency of occurrence of the motive combinations within the sample.*
Column 3 *gives the number of sample façades in which the motive combinations occur.*
Column 4 *gives an index of variability as the ratio between the number of motive combinations and their frequency of occurrence.*

		motif	lim. mot.	lim. sub-mot.	sub-mot.	1	2	3	4
common elements	cornice	16	5	0	4	27	31	31	0.87
	wall	2	0	0	1	3	31	31	0.10
	banister	4	4	2	25	26	32	30	0.81
	stair banister	3	2	1	13	14	28	28	0.50
	stairs	7	7	0	6	16	28	28	0.57
	doors	5	5	8	17	36	69	31	0.52
	windows	12	5	8	7	39	52	31	0.75
rare elements	frieze	2	4	2	13	13	20	16	0.65
	medaillon	4	8	0	5	10	17	17	0.59
	tympanum	10	2	0	4	8	16	16	0.50
	column	5	1	0	7	12	19	18	0.63
	shop window	2	0	0	0	2	4	4	0.50
	bracket	4	0	0	0	4	4	4	1.00

It is possible to further demonstrate the correlation between formal articulation and perceptual scale by calculating the ratio between the number of sub-motifs and motifs for each element (index of articulation). In fact, this ratio correlates with the perceptual scale for most elements with the exception of the wall and the frieze (Table 1). However, the low level of articulation of the wall is compensated by subtle variations of colour. By contrast, the frieze element has a very high index of articulation, despite the fact that it can only be viewed from a distance. This rich articulation of the frieze can possibly be explained by the fact that its purely ornamental function (as opposed to the multi-functional nature of cornice, window and bannister) prompts a greater degree of playful expression in its formal treatment. The richness of the frieze might also be a compensation for the monotonous aspect of the wall in which it is embedded. All these examples indicate that the indices of variability and of articulation yield an insight into the nature and use of the architectural elements.

The spatial distribution of motif combinations can also be studied with reference to the location of the façade in which they are inscribed. In the sample studied it was found that each street and avenue possesses a similar amount of exclusive motif combinations. This finding indicates that the motifs of architectural elements do not only serve to individualize buildings, but also to differentiate streets.

Finally, the symmetry groups involved in the composition of the elements as well as those characterizing their motifs are compared in terms of their variety and frequency. For this purpose the alternative method of coding motifs is employed, namely the one using symmetry groups. Table 2 lists the number of distinct symmetry groups found on different scales in our sample. This table shows that the number of symmetry groups involved in the composition of motifs is considerably greater than those involved in the composition of elements within the façade. The motifs have a richer variety of composition than the overall façade. Table 2 also shows that within the upper subgraph only three distinct symmetry groups occur on scale I, while fifteen occur on scale II. These results show that the variety of symmetry groups grows as the spatial scale diminishes. This seems to be the principle underlying the architectural code in the studied environment.

The analysis of the graphs described so far points at the various means which serve to differentiate and identify individual houses, but it also explicits the common lexical repertory as well as the syntactic code underlying the composition of the façades.

On the basis of the various indices developed here above – the frequency of element combinations in the façade, the type and frequency of chains per element and the frequency of symmetry groups per element – it is possible to derive a paradigmatic graph for the entire sample. Each façade graph can thus be compared to the

Table 2. Number of distinct symmetry-groups per spatial scale.

scale	symmetry groups
I	3
II	15
III	25

paradigmatic graph in terms of type and number of deviations which constitute its individual attributes. Further stylistic regularities might be detected in the coincidence of such individual attributes within a façade as well as in their spatial distribution within the sample.

6. Conclusion

The modelling procedure described in this paper presents a method for the analysis of architectural expression. It is based on the decomposition of façades into a certain number of paradigmatic elements whose formal variations and combinatorial patterns are coded by symmetry groups and linear graph. The method has the advantage of formalizing each element's particular configuration as well as its contextual position and, as such, it represents the façade's expressive structure. The application of the method to residential façades shows that the plane of expression possesses its own morphological syntax which, like in linguistics, might condition the signified content of the individual expressive element. Further, the analysis of the formal structure of the façades reveals that a certain amount of clearly decodable meaning is inherent to architectural expression, or to its process of production, for example, the relationship between the spatial scale and position of the elements and the number of their paradigmatic variations.

The analysis described above can be completed by a parallel analysis of colour composition and contrasts and of various physical data such as material, production means and maintenance levels. In our own research we study the subjective significance of the dominant characteristics identified in the formal analysis. We also intend to apply this methodology to a comparative study of social and geographic variables in architectural language.

Although the modelling procedure described in this paper was developed for the specific purpose of analysing the formal structure of vernacular façades, the method has a far-reaching potential of application in other fields of architectural study, for example, in architectural history, where it could be instrumental in the identification and differentiation of styles, whether of a particular architect or of a specific period. It is also possible to envisage analogous procedures for the analysis of architectural plans and sections. Eventually three-dimensional formations could be analysed using space symmetry groups. The application of symmetry groups to the analysis of architectural language could also be extended by the use of polychromatic symmetry as developed by the mathematicians Shubnikov and Belov (1964). The use of polychromatic symmetry could allow, through change of colour as an additional operation, the modelling of dynamic processes such as the changes in patterns of use over time.

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