ABSTRACT

This thesis aims at establishing a set of rules for the design of a house type in Boston's Back Bay. The theory of which this study is based on is built-form theory which undertake the morphological development of the spatial arrangement. The house type of Back Bay conceived as a set of rules that can prescribed formal relations among chosen elements at the block and building levels.

The rules are applied for generating a house type. Type exists in the social body, which consolidates social agreement and therefore is closely related to the sharing of images. Rules can be used for describing the images in terms of physical forms and communicate the idea of type with architects and people who live the society. Also, they serve reference criteria and design guidelines, as control tools of design in our physical environment.

This study consists of three major parts: Formulating design rules for urban block, facade and floor plan. For each part, a series of analyses are adopted:
(1) block level: physical system and spatial system
(2) facade system: facade decomposition, hierarchical organization and generative rule system
(3) floor plan system: floor plan structure
A set of dimensional system are also generated for the test of design rules.

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Acknowledgments

It has been a year and six months since I began my thesis study on design rule-making. There are many people I would like to thank.

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DESIGNING A HOUSE TOPOLOGY
Chapter 1 Introduction

The Background

The Logic of Built Form

The prevailing research topic in the development of logic is that of the distinction of the form and the meaning of logic. The former emphasizes the logical structure of sentences and deductions, or the relations between signs in abstraction from their meaning. The latter emphasizes only the factors excluded by the first. Using contemporary terms, we may call them syntax and semantics respectively. Theoretically they are not incompatible, but rather complementary to each other. A reasonable inference represents the correctness of its syntactical form, which does not necessarily assure that the meaning related to experiences and facts is absolutely correct. The application of this idea became an epistemological stand point in other academic fields, such as linguistics and architecture. In linguistics, a tendency that focuses on the structure of the syntax rather than the semantical content has appeared in modern linguistics. For instance, the sentence "Music and dog live in the blue" is syntactically correct, but meaningless in the understanding of the language. Because the semantics in language involves too many factors which are non-linguistic, we can set up the discussion of the form and the meaning indi-
vidually to develop their potentiality in linguistics. In the de-
velopment of the research of physical environment, the study
based on the concept of the distinction between form and mean-
ing is not a new idea in a strict sense. However, the applica-
tion of this idea expresses the possibilities for studying the built
environment. This idea suggests the way that can be taken to
develop the theory-oriented knowledge of form. But it is not
the intention that this approach can be used to establish the
whole system of knowledge about the built environment.

The Form of Built Environment

The built environment is in a continuing condition of
transformation. These transformations are the result of hu-
man action. Human beings caused the built environment to
exist and allows it to do so through continuing changes. When
the first human beings built their dwellings, they began to con-
struct their built environment. As opposed to the given ntatural
environment, we take the built environment as the part of the
world that is consist of artifacts. Therefore, to study the form
of built environment, we intend to know how the built-form is
made and in what kind of forms it has existed through genera-
tions. If we intend to learn about the transformations of the
built environment, the changes can be identified by the pat-
terns of the environment or the variations on particular themes
during a continually intervening process.

Because the result of human actions are not arbitrary, a "system" in the morphology of the built environment can be characterized. There exists a "form" which internally controls the structure of the built environment. By the virtue of this underlying form, any composed phenomena, such as language, a cultural system or a city, can be presented to the built world. This form is the framework that constitutes a set of composed phenomena. For instance, a set of words arbitrarily put together not in accordance with syntactic rules, cannot constitute an understandable sentence. However, human beings can organize these random words with the form they make in language. Similarly, a tree is not just arbitrarily composed of leaves, sticks, branches, trunk, as a city is not a random assortment of buildings, streets, blocks, districts, neighborhoods and so on. Human beings must be able to systematize the complexity of the physical world with an understandable primary form.

In studying the built environment, a question emerges: How many forms can people characterize and how can they explore these forms? From a logical point of view, this issue can be compared with the question of how many inferential rules a logician can set up in order to define the range of her/his research. Suggestively, a form can be developed into
Designing A House Typology

A descriptive theory, which would involve with a limited set of forms and each form represent a particular concept of spatial arrangement. The goal for establishing a descriptive theory should contain five attributes: 1) the ability to compose and decompose; 2) the ability to evaluate; 3) the ability to recognize; 4) the ability to generate and 5) the ability to predict. A well-established descriptive theory can be achieved in developing the five attributes. Then based on the descriptive theory, the form can be further developed in the built environment to explain the context of the study. Hence, this explanation can be systematized into a theory, which focuses on how the physical environment is generated and understood, and how the structure of the built form can be generalized a conceptualized approach.

Theoretical Concept of Built-form theory

In attempting to establish a theory about the form of the built environment, the target to be studied must be defined, and the kind of knowledge clarified. Can a well-established theory explain the phenomena in the context of the physical environment? And can a theory predict something that is still unknown? A theory has to own the ability to explain the facts, instead of merely describing them. Therefore, there should exist a theoretical language for the purpose of

2. This five abilities can be exhibited in a logical format:
   (T - descriptive language, E - elements, F - form, S - formal structure)
1. the ability of composing and decomposing
   \[ F \rightarrow [T] \rightarrow S(F) \]
2. the ability of evaluating
   \[ S_1, S_2, F \text{ given} \]
   \[ F \rightarrow [T] \rightarrow S_1 = S(F) \]
   \[ S_2 = S(F) \]
3. the ability of recognizing
   \[ F_i \text{ given} \]
   \[ F_i, i>2 \rightarrow [T] \rightarrow S(F_i) = S(F_j) \quad i=j \]
4. the ability of generating
   \[ S_0, E \text{ given} \]
   \[ S_0, E \rightarrow [T] \rightarrow F_i(E) \]
   \[ S_0 = S(F_i) = S(F_j) \quad i=j \]
5. the ability of predicting
   \[ F, S(F) \text{ given} \]
   \[ F, S(F) \rightarrow [T] \rightarrow E \]
   \[ S : E = F \]
conveying the logical content of a theory. In the methodology of science, it usually divides the language of science into two parts - the observation language and the theoretical language. The observation language uses terms designating observable properties and relations for the descriptions of observable things or events. And the theoretical language contains terms which may refer to the unobservable events and the unobservable aspects or features of events. For instance, in physics, "temperature" is a theoretical language, while "object A is 20 degree warmer than object B" is an observable language.

A descriptive theory describes the observable events by using the theoretical language. The language should be able to describe the real-world phenomena through the facts and convey the idea of the theory convincingly to the people who try to understand it. In addition to the descriptive ability, the theoretical language should explain and predict observable things. It is the descriptive environmental theory that can explain and predict to the formation and transformation of the built environment. As to the issue of what is a good built environment, a normative theory can discuss a value system for making a good environment. Basically, the distinction between descriptive theory and normative theory is conceptually obvious, but it is possible that a descriptive theory can be used as a norm.

To study a descriptive built-form theory, the target to be focused on usually contains the form which is compositional. Selecting the elements and discussing the spatial relations among the elements are the groundwork for shaping the built-form theory. In doing so, a set of rules can be generated to discuss the spatial relation of elements.

**Synopsis**

The logical concept applied to the built form is the viewpoint I adopt to undertake this study; the underlying form of the built environment is what I intend to explore based on the establishment of a descriptive theory; and the search for the possibility of generating an efficient rule system explain my motivation. In the following chapters, I will restrict myself to more technical presentations, and engage in a more analytical discussion. Now I will give a synopsis of this thesis. Basically, this thesis contains a series of rule systems which are generated from the observations of urban tissue level to infill level. The rules are the descriptions which provide the means to communicate with people in terms of spatial relations and physical organization. In this thesis, I choose the houses in Boston’s Back Bay as a case study, which own its identity and has a sophisticated characteristic in a cultural sense. In Chapter Two, I introduce briefly a cultural and topographical

4. The terms are based on the concepts which constitute a particular way of looking at things adopted by SAR* researchers. The levels of physical environment have been built up by SAR methods from the unit spaces to urban tissues.

*Tissue  \[\rightarrow\] Neighborhood
Support \[\rightarrow\] Dwelling
Infill \[\rightarrow\] Room
Furniture \[\rightarrow\] Unit space

*SAR: Stichting Architecten Research
ground of Back Bay to explain the evolution of its city planning in try to understand what caused this area to maintain the architectural style for over a century.

By understanding the cultural and social background of Back Bay, one would question whether cultural or social factors affect the formation of this neighborhood from an architectural viewpoint. Are the transformations of the built environment related to the power of economics and politics? If so, how do they influence on each other? When in studying the house type in Back Bay and trying to formulate rules for designing the house type, can architects do it independently instead of associating it with a variety of cultural and social factors which might have determined the form of the buildings.

Chapters Three, Four and Five discuss and exhibit the rules for designing the house type of Back Bay. Chapter Three focuses on formulating the rules in urban block level, and Chapter Four and Five concentrates on the building level which the former discuss facade system and the latter plan system. All three rule systems contain the selection of elements and the operation of spatial relations among elements.

In Chapter Six, I will discuss the nature of design and rule-making to see how they are related and how they can be
backdeveloped into a house typology. If a type is shared images which are a family of forms familiar to a group of people by common experience, why is that describing a type of form has to do with formulation of rules? Can a type be designed by using a set of rule to control the design quality? These are the kind of questions I try to deal with in Chapter Six.

The final chapter concludes the thesis. From the formulation of the design rules for understanding a house type, a new starting point for searching for a set of well-established rules begins to emerge.
Chapter 2 The Development of Boston's Back Bay

Cultural and Socio-economic Background

As a historical town, Boston started to boom in the early nineteenth century because of its rapid economic and cultural growth. The variety of trades brought by the commercial activities expanded the city’s economic growth. Under the pressure of growing manufacturing and the advent of railroads, which carried manufactured goods from distant parts of New England to Boston for transshipment, the decade of the 1840s was the most prosperous in Boston’s shipping history. Also, more than any other single factor, it was the railroads that changed Boston from a provincial town to a thriving metropolis. With the growth of rail and sea commerce, Boston's manufacturing greatly expanded and diversified. For instance, in the 1830s, the city developed the ready-made clothing industry which became the largest undertaking of Boston area. Because New England led the country in textile manufacturing, Boston became the dry goods center of the nation; and because of extensive shoe manufacturing, the city emerged as the nation’s leather market. The commercial and industrial life during the 1840s and 1850s changed enormously in Boston.

Culturally, the change was equally significant. First of all, many students and young people from the new mercantile
families traveled to Europe and brought back to Boston European art collection. For example, Thomas Gold Appleton, from a prominent Boston merchant family, brought engravings in Rome which he later gave to the newly organized Boston Public Library. Even before the Civil War, he assembled the first large collection of paintings in Boston. The interest in paintings spread with the increase in wealth and cosmopolitan awareness. In addition to art collection, Boston also saw the publication of four musical magazine between 1820 and 1839; a professional music school, the Boston Academy, with an orchestra of its own which was founded in 1839. Music was introduced in the local public schools before the mid-century.

A long list of civic improvements and new institutions bear witness to the city's prosperity and optimism and to her new sense of civic dignity. For instance, the Boston Public Library was founded in 1852; a new City Hall began in 1861; and a Free City Hospital opened in 1865. An adequate water supply was provided in 1848; and by 1834, gas was beginning to replace oil lamp for street illumination. Therefore, under this economic expansion and civic improvement, the conception and beginning of the Back Bay district symbolized Boston's wealth and optimism in the late 1800s in addition to the pride and ambition of its civic leaders. However, this period of turbulent change began to level off. Thereafter, a progressive Boston now turned her attention to the maintenance of the status
It is difficult to say precisely when the change took place - maybe it came sometime after the Civil War, but certainly by 1890, the change was completed. At first, Bostonians probably were unaware of their new outlook - but later they gloried in it.

**Topographical Development**

Half a century after Boston became a city in 1812 was a time of terrific change. The emergence of Back Bay was a part of this change which included an unprecedented expansion of the geographical borders of the city.

Boston, as we look down from an aerial view, is an irregular peninsula that is practically an island in the center of the Inner Harbor. (Fig. 2-1) Topographically, the city's shoreline is irregular and cut by four deep coves or bays: South Cove to the southwest of Fort Hill; East Cove, or Great Cove, on the northeast which serves as the city's principal harbor; North Cove to the west of Copp's Hill, and the Back Bay. The Back Bay is really the estuary of the Charles River, as it cuts behind the peninsula on the southwest and almost isolates it from the mainland.

In 1852, the bay was formally proposed to fill in from
the Public Garden as is the South End along the edge of the Neck. (Fig. 2-2) Back Bay was literally a bay in the back of the town. The Back Bay’s 580 acres, mostly mud flats at low tide, were filled in and transformed into one of the most beautiful and architecturally important areas of Boston, and indeed the country. The Back Bay was not, however, a highly planned enterprise. It developed gradually throughout the nineteenth century.

Inspired by the French approach to city planning, Architect Arthur Gilman laid out a well-devised sectional street system with broad thoroughfares running East-West and cross streets running North-South. He also specified sixteen-foot alleys at the rear of house lots for deliveries by the butcher, the baker, and the grocer. And by placing restrictions on the property, the district was ensured the quality of homogeneity: buildings had to be at least three stories high and constructed of masonry and, except for minor appendages, a building facade could not project beyond a uniform line set for each street. These restrictions applied to properties sold by the state.

Most of the neighborhood was noted for its dignified row houses, which was originally intended as an industrial district. The Public Garden was committed by the state as a park space which was originally recommended to use the land for housing. Another interesting aspect of planning for the
Fig. 2-1 Map of Boston and vicinity showing the original shoreline and indicating the location of the Mill Dam and the earliest bridges
Taken from *Houses of Boston’s Back Bay* by Bainbridge Bunting  Pp.24-25
Fig. 2-2  Map of the Back Bay and adjacent area.

Taken from *Houses of Boston’s Back Bay* by Bainbridge Bunting  Pp.30-31
Back Bay was the consideration given to the creation of a so-called cultural district. In 1861, for instance, the legislature enacted the law of setting aside one block for the Museum of Comparative Zoology and the new Massachusetts Institute of Technology. In the years after the Civil War, the success of the Back Bay quickly became apparent, as one of the great visionaries in Boston planning. Robert Copeland, formulated further development schemes. In 1872, he published *The Most Beautiful City in American: Essay and Plan for the Improvement of the City of Boston*. Copeland, a “landscape gardener” with offices in Philadelphia, was among the first in the United States to use the term “city plan,” and his book offered Bostonians a careful consideration of how to segregate the industrial and residential section of an urban area.

Before the Back Bay fill, a long mill dam was constructed by Roxbury Mill Corporation to realize the power for the water mills. The power project, completed in 1821, was not a financial success, because of competition from the more practical steam engines and to the fact the efficiency of the water-driven mills was soon reduced when the Commonwealth permitted the construction in 1834 of two railroad causeway, which impeded the flow of water in the lower basin. Meanwhile, population pressure within the Boston peninsula was constantly increasing, and the increasing land values of the older residential section of the city forced householders out of the
older area. Also, the lack of efficient transportation system prevented the population from moving out to the suburbs. In short, because of these reason, the landfill of Back Bay which was close to the center of Boston, was the place for the new home sites. The planning of Back Bay area was not determined at any specific time. Instead, it went through many stages, including its layout, green space, park space and the axes of street pattern. (Fig. 2-3, 2-4, 2-5)

Functioning as barriers to isolate the Back Bay from the chaos and confusion of the other sections of the city, the Fenway Park and the Public Garden enabled the Commonwealth to create a uniformly desirable residential area and to regulate it with strict building restrictions. The construction of the Storrow Memorial Drive in 1951, cutting between the residential streets and the river, also isolated the Back Bay from the recreational area which for twenty years contributed so much to the district.

In addition to the residential houses which contribute to most of the use of the buildings in this area, public buildings, such as churches, schools and cultural institutions were spread throughout the neighborhood. The city strategically developed the Back Bay as the city’s principal cultural area which became a fitting ornament for Boston.¹

Fig. 2-3 Plan for the Back Bay area in 1860, prepared by Janes Slade, city engineer

¹Taken from Houses of Boston's Back Bay by Bainbridge Bunting Pp.376

1. The historical information in this Chapter cited from the book of "Houses of Boston's Back Bay" by Bainbridge Bunting and "Planning the City Unpon a Hill" by Lawrence Kennedy.
The Development of Boston's Back Bay

Fig. 2-5 Detail of a Plan for the Back Bay area in 1863, prepared by H.M. Wightman, surveyor.

Fig. 2-4 Plan for the Back Bay area in 1861, prepared by H.M. Wightman, surveyor, and James Slade, city engineer

Taken from *Houses of Boston's Back Bay* by Bainbridge Bunting, pp. 377 and pp. 379
Form and Society

There are various factors which affected the formation and transformation of the built environment. They could include cultural background, material, climate, economy and politics factors. The form of a building can be determined by one of the social and cultural factors of the Back Bay. There existed a kind of social value which decided where the building could be situated and what kind of architectural style represented social consensus. For instance, most of the large houses were located on the north “sunny” side of Commonwealth Avenue or the water edge of Beacon Street. Because of Boston’s cold weather, facing the sunny side of the street is the accepted value which determined the width of the house. However, the rule system that I intend to generate is the descriptive theory of the built form, which is set up to discuss the spatial relation and the compositional logic of the built environment. Aspects of the local economy, politics and culture will be treated as a background for the discussion, as opposed to the compositional structure of the built form. By taking this viewpoint, I assume that the separation of this two approaches can be established. This hypothesis is somehow controversial which will be clarified further.

In a general understanding, one realizes that the form of spaces can be influenced by the different social factors. How-
ever, in an academic viewpoint, one would like to know how the form of spaces and social factors are related and influenced each other. On this point of view, the form of space is considered to be a variable which is not independent and can not exist on its own logic. Only the social factors which are constants can determine the form of spaces. Space is generated by the power of this constant. To establish a spatial theory, one has to use social, economic or political factors as selected elements to explain the formation of the space. In this thesis, I will argue this viewpoint and develop my descriptive theory under the premise that “social factors do not change the compositional logic of spaces.” If we see the spatial theory which are influenced by social, economic, and political theories as theory of genealogy, and the compositional theory as a theory of morphology, then the former explains the emergence of the phenomena by virtue of external consideration, while the latter interprets things by the internal structure of form. The spatial form exists prior to its involvement in the social context, and it can be discussed independently. As long as a compositional theory of the built form is generated, it can explain the phenomena related to the social, economic and political contexts. This assumption is the concept that this study is based on.
Chapter 3 Design Rule I - Urban Block System

Introduction

After briefly introducing the topographical and cultural development of Back Bay, we have fundamental knowledge about her evolution from a peninsular small town turning into a metropolitan city. Particularly in the Back Bay, the successful control of architectural planning explains its reputation as the representative architectural style of Boston's housing which is considered one of the most beautiful city in the country. Architecturally, it is further to be classified as a Back Bay house type. The house type can be described according to the image which carries its architectural quality: red bricks, bay windows, ornamental details and mansard roof and so on. When we walk through this area, we can feel the atmosphere of its architectural coherence and visual richness. If we ask people to sketch the house of Back Bay, more or less, we can judge it by the drawing that this is the house of Back Bay. However, if we try to describe it, the description will be diversified according to different people coming from different culture and background.

Type is a spatial form that consolidates social agreement. The house type of Back Bay emerged through a long course of
evolution, which is considered to be exemplar in consolidating the social consensus about what a beautiful city is like and how to set up urban design guideline. For an urban designer, how to create the Back Bay quality is the issue that draws her/his attention on what is the house type of Back Bay. One might ask "Is there a systematic way to describe the type?" If we are considering about creating the same quality of houses of Back Bay, how can we communicate to a designer the quality of the house? Accordingly, we should make an explicit way for designers to follow, to a certain degree, without constraining the possibility of design variation. Design is not a random behavior, it must deal with constraints and it must be guided by certain rules, such as building codes. Therefore, rules about a house type must be formulated in order to generate the built-form.

The making of the rules is based on the built-form theory that we try to make a descriptive system to explain the form of physical environment. Ideally, the rules should be able to "describe" the composed elements and compositional relations of elements, and examine or evaluate whether any other context can be the same structural system or not. Furthermore, they should be able to generate the same quality of the environment under study according to the defined rule system. By taking the house type of BACK BAY as a case study, we make design rules to control the design quality. The rules can be
followed to generate the type which the forms bear resemblance to one another, but they are not identical. Basically, they can be used for a design guideline to preserve a good environment.

**Rule-making I - Urban Block**

In order to make rules for designing the houses of Back Bay, we need to specify the ultimate goal of the rule system. If we take a look at Back Bay, the visual richness and spatial legibility are the qualities that give the sense of coherence of the control of quality. In physical terms, the control of the quality covers the issue taking from urban block level to interior spaces of the houses. For instance, the grid system of the blocks creates the "street wall" as a definer of the street space, which in itself is composed of the facades of individual buildings. (Fig.3-1a, Fig. 3-1b) This system, defined at urban block level, affect the perception of Back Bay's spatial pattern.

When a number of similar building aggregates, a certain kind of block type will be found. At urban level, the main structure is decided by the road system. If we determine the block type be the road system, we can make decision, then, about what kind of aggregation of the buildings can be. As long as we fill in the buildings into the block we have made, further efforts toward building a formal rule system for gener-
ating the house type of Back Bay can be done.

Therefore, to make rules at block level, we set up the goal to generate a grid system which describe the relationship among set-back zone, built-zone and street system. Also, the way of how lots are arranged is considered critical to the forms the type of houses in Back Bay.

If a type is a particular way of doing things, then there are three rules which can work "with style" and explicitly describe the block type of Back Bay; (1) selecting a particular kind of elements; (2) arranging elements in a particular way; and (3) following a particular kind of procedures. Therefore, we distinguish at least two kinds of rules: the form rules, which are about determining the elements and their relations; and the procedural rules, which are about sequences of doing things. A form rule tells us how to select elements and how to relate one another spatially. A procedural rule usually tells us how to operate the relation of elements in an if-then format. In our case, we define the procedure of making the grid system much simpler than deciding the elements and their relations. Based on the concept of the two kinds of rules mentioned above, we discuss the compositional rule of block with physical system and spatial system. The physical system establishes the rules by discussing the relations of selected elements and the spatial system discusses the spatial relations by

Fig. 3-1a Site Plan of Back Bay
Fig. 3-1a Building lots of Back Bay)
Design Rule I - Urban Block System

defining the arrangement between the built sectors and the sectors of open spaces.

In order to describe the rules in a formal way, we, firstly, give the definition of the selected elements and then, the description of the rules. For a designer taking the rules to generate the block types of Back Bay, he/she should take the rules both of physical and spatial systems to finish the whole design-making process.
Physical System

Definition of Elements

1. Unit
   - a spatial object with ownership, such as buildings (here ownership means the right which can be controlled with respect to the spatial change, management of the unit, instead of economic exchange or management.)
   - the shape of buildings can be irregular, usually there are four kinds of shapes. (See Figure 3-2)

2. Access
   - in-between space of units and streets providing the connection of two spaces

3. Lot
   - land property with buildings on it and usually treated as independently single units controlled by one owner.
     (If the land property is shared by more than one owner, it is treated as one unit.)
   - there is no limit for the area of lots. (But in reality, the

Fig. 3-2 Four kinds of shaped of the units
Design Rule I - Urban Block System

1. Linear

- maximum area cannot exceed one block and the minimum area should be restricted according to the building code.

2. L-shape

3. Pocketed-shape

4. Clustered

5. Scattered

4. Fabric/Fiber

- if a number of units are composed through a certain kind of form, we name it as urban fiber (See Figure 3-3)
- there are various ways of composition among units. (See Figure 3-3)
- in this thesis, considering the practical situation, we take the linear as a referential type which we name it the fabric in the context of the urban structure.
- by making composition of the fabric, the urban fiber is formed

Fig. 3-3 Different compositions of the units

Compositional Rules

When looking for the compositional rules, we find the units and street system play an important role with respect
to the arrangement relations. And the access can examine whether the unit and street are connected. There are some rules which should be followed when composing these two elements:

**Rule 1**
*Every unit should be accessible to the streets or the streets can access every unit*

**Rule 2**
*Units cannot locate on the lots which do not have land property*

**Rule 3**
*The direction of the units should be perpendicular or parallel to the street. (See Figure 3-4)*

If we set up the fabric with W in width and L in length, then L/W=Q means the minimum number that can make
the fabric turn into another direction. The value of $Q$ should be an integral number, otherwise, if the fabric turn into another direction, the block will not be completely close, like Figure 3-5 shows. If the fabric needs to be expanded by taking a number of units, we can give the value of $Q$ or its multiples to show how the fabric can be turned into another direction. In order to distinguish the long side and the short side of the fabric, we assume $F=Q \times W$ then $F=L$. (Figure 3-5) Since we define the fabric as the relation of $F=Q \times W$, it will help us to discuss the composition of units and streets.

![Diagram](image)

Fig. 3-5 The compositional relations of the fabric

**Rule 4**

*Compositional Types of the Units*

*By taking a section of the street which could be linear and included cross-section, there are six kinds of composition for the units:*

---

40
Fig. 3-6 Different compositions of the units by taking a section of a street
Here we can take the five rules above to generate typical blocks. (Fig. 3-7)

**Instance I**
- Rule 4.1
- Rule 4.2.2
- Rule 4.2.4
- Rule 4.2.4
- Rule 4.2.4

**Instance II**
- Rule 4.1
- Rule 4.3
- Rule 4.2.3
- Rule 4.2.4
- Rule 4.2.4

**Fig. 3-7 Two instances of typical blocks**
**Rule 5**

*The shape of the unit can be rectangular, or irregular. Basically, one unit locates on one lot, but it is acceptable that a unit sits cross on two or more than two lots. (Fig. 4-8) Every unit which is parallel to each other should be located side-by-side in the front of the streetside.*
Spatial System

Definition of Element

1. Built Zone/Public Zone
   • the area that is occupied by a number of buildings and taken as a solid zone in contrast to the area of public zone which is void, usually including streets, sidewalks and setbacks.

2. Street
   • public space which is accessible and not owned by any single unit (this is not included in private streets)
   • all streets are linearly arranged
   • there are three kinds of streets defined by their width and the volume which is calculated by the number of cars passing by a section of a street per hour: primary street, secondary street and alley.
2. Rules

Typologically, there are two kinds of block types which can be named as simple and complicated blocks according to the way that buildings cluster. Usually, a simple block consist of a group of buildings arranged linearly or buildings enclosed as a courtyard. While in a complicated block, a number of buildings can be grouped in a number of ways which can be analyzed hierarchically. In the case of Back Bay, its block type belongs to the simple one, which can be analyzed with the relation of the built zone and the public zone in terms of dimension and spatial arrangement.

Based on our observation of the spatial system of Back Bay, we can specify several characteristics:

(i) Primary street run in the east-west direction. The spatial enclosure of the primary street is defined by the combined width of public distribution zone and its two flanking setback zones, and by the height of the street wall. The public distribution zone contains the right of way and two side-walks.

(ii) Secondary streets run orthogonally to primary streets,
Fig. 3-9 The current grid system of Back Bay
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each providing access through alleys to backyard in their adjacent blocks. Because set-back only exists along primary streets, the width of the secondary street-space is much smaller.

According to the observation, we can make a diagram by defining the grid system with the street system and the blocks. (Figure 3-9) To build a set of rules of this grid system is, in fact, to deal with built zones and public zones with respect to their spatial relation. Therefore, we can have a basic structure for the relation which is shown at right . (Figure 3-10)

Based on this grid structure, four rules should be followed in order to generate the block type of Back Bay.

**Rule 5**
*If the width of the block is larger than the two-times length of a unit, then an alley should be placed in between the block. (Figure 3-11)*

**Rule 6**
*Primary streets should run in the east-west direction, while secondary streets be perpendicular to primary streets.*

Fig. 3-10 The analytical grid system

Fig. 3-11 The rule for setting up an alley between units
Rule 7
Every unit should have a set-back zone in front of the primary streets.

Rule 8
A dimension system should be followed for the blocks and the streets. (Fig. 3-12)

To discuss the dimensional system of the grid pattern, we set up two modules for the east-west direction and two for north-south direction individually:
North-South  275' (Wide ban) and 25' (Narrow ban)
East-West  50' (Wide ban) and 10' (Narrow ban)

For North-South direction, one can choose two Ws and four Ns to make the vertical grid with variation. (Fig. 3-12a) And for East-West direction, there are one W and four Ns that can be chosen to make the combination. (Fig. 3-12b) By adopting this dimensional system, we have a simulation for the grid pattern of Back Bay. (Fig. 3-13)
Fig. 3-12b Dimensional system for east-west direction
Design Rule I - Urban Block System

<table>
<thead>
<tr>
<th></th>
<th>2Wv</th>
<th>2Wv + 4Nv</th>
<th>2Wv + 2Nv</th>
</tr>
</thead>
<tbody>
<tr>
<td>550'</td>
<td>2Wv + Nh</td>
<td>2Wh + Nh</td>
<td>2Wh + 2Nh</td>
</tr>
<tr>
<td>650'</td>
<td>Wh + Nh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>700'</td>
<td></td>
<td>2Wh + Nh</td>
<td>2Wh + 2Nh</td>
</tr>
<tr>
<td>800'</td>
<td></td>
<td></td>
<td>2Wh + 2Nh</td>
</tr>
</tbody>
</table>

*Wh or Nh: East-West direction/ Wv or Nv : North-South direction*

Fig. 3-13 A simulation of the grid pattern of Back Bay
Chapter 4 Design Rule II - Facade System

Architecturally, the facade of a house is the physical space of exchange between outside/inside and public/private. It gives the sense of how a type can be explicitly described in accordance with the outlooks of the buildings. And the facade itself contains various possibilities to be designed as a certain kind of style. Because of the varieties of designs, to make rules for the facades, the scope of which the rules can be generated and defined.

Design rules can be formulated from various perspectives. A list of possible rules in a group of artifacts is potentially endless. There are also numerous ways to describe relations. In the building facades, we primarily focus on the issue of how to generate rules to describe the relationships between roof and main body, and where the baywindow can be placed in the facade. In addition, based on the main structure of the facade, the decorations which can be read in a stylish way are to be appropriately constructed.

Method of Analysis

Basically, there are four sequential steps to be followed. First, by observing the facades, we decompose them into
recognizable elements and find the relations according to the arrangement of the elements. Second, by using the concept of hierarchy to develop the analytical process, we take "division line" as a basic tool to describe the facade as a framing system. Third, after the analytical framework has been established, we find the similarity and distinction among each abstracted facade, which some of them can be grouped up in terms of the arrangement of the division lines. Therefore, we try to make rules for generating the analytical facades. Fourth, if we fill in the details into the framework, such as materials, stringcourses, lintels of windows, and cornices, the facades for the houses in Back Bay can be completely produced. Finally, after the rule system to generate the framework of facade has been developed, we further establish the dimensional system for completing the design process.

The Observation

In a general observation of the facades, we see three distinctive features which are composed of the shape for the houses: a "base," extending up to the first floor line; a "body," extending from the base up to the cornice line; a "cap," extending from the cornice line at least a feet up; and in many cases cap formed by a lived-in Mansard roof. (See Fig. 4-1)
Obviously, the distinction between roof and main body of the building is quite visible in terms of materials and styles of architectural forms. Baywindows, appearing mostly in the front streetside, are a strongly visual configuration which provokes the perception of the Back Bay as a "rich" environment. If we take a close look, appropriate architectural decoration is distributed around door and window openings, on the main cornice, on the levels of the various floors, and on the basement, which creates the sense of visual richness instead of boring, ambiguous or chaotic. Usually, the accretion of architectural forms such as window frames, stringcourse and cornices dominate the appearance of the facades.

Another factor which contributes to the unique characteristic of the facades is the variety of roof forms that appear: flat, gable, hip, or mansard roofs. The variations in roof design create frequent changes in cornice height and give a serrated silhouette to the streetscape.

Analysis I - the Decomposition of the Facades

In Figure 4-2, the decompositions of the facades are shown based on the observation. (Fig 4-2a,Fig4-2b)
Fig. 4-2a Decomposition of the facade
Fig. 4-2b Decomposition of the facade
Basically, a facade is composed of a roof, baywindow, entrance door and stairs and various decorations. All these elements are designed according to different organizations of the elements or different ways of divisions and fill-ins. Therefore, we can shape the idea of outlining the facade system with frames, trying to divide the frames and to fill details into the divided areas. This framing idea allow us to construct the framework of the facades. Based on this, we can further develop the details of decorations and use appropriate dimensional system practically to complete the design process.

Analysis II - the Analysis of division Lines

According to the Analysis I, if we can make division about the frame of the facade and do more operations on the inside division, the shape of facade can be decisively formed. Accordingly, this section will focus the discussion on the determination of the framing system and the method of making division.

The shape of a facade is primarily decided by some division lines, framing the outline of the basic structure. We can observe the facade by interpreting it through a number of elemental lines, which could be a cornice line, a line between two sides of a baywindow, a stringcourse, or a line on top of a

roof. In addition, the elemental line could also be treated as the division of the windows and floors. Hence, taking a division line as an analytical tool is a way to help us construct the outline of the facade. However, how to use the division line to generate a frame is the issue which bring us to the idea of hierarchy to further develop the whole analytical method. The following case exemplifies the hierarchy of division line: If there are two sets of lines A and B, where A changes B always changes too, but when B changes, A does not change, we say that A is dominant over B, or that the A line set is in a higher level than the B line set¹. Based on this hierarchical concept, we analyze the houses of Back Bay by using division lines.

There are at least six levels to generate the shape of facades, which in our case, can go further to eight levels developing on the form of the facades. The first level starts with the ground level. The second level determines the main body and the cap. The next level shows the way of arranging the baywindows, and every level goes further into more details. According to this hierarchical procedure, we can get the frame of the facade. Figure 4-3 shows some selected cases explaining the process of the analyses. The building facades I have chosen for analysis are sifted through my first rough classification, which on my viewpoint are very typical in the houses of this area. (Appendix I)
Fig. 4-3 Facade Analyses
Fig. 4-3 Facade Analyses
Analysis III - Framing Types

Since we have produced the facades with division lines, we will try to systemize the analysis by categorizing them level by level. Here, we make a tree diagram to easily realize the whole system, and thus the basic types of the analytical facades can be seen. (Fig. 4-4)

Usually, the basic frame of the facade is formed at the third level. There are seven kinds. (See Fig. 4-5) Those frames are composed of two parts, the cap and the body. The cap has six types and the body has two. (See Fig. 4-6)

In this analytical frames, the facades are composed of several lines which spatially represent the division of main body and roof, the ground floor, and so forth. In order to distinguish the bottom line of main body which is the line of ground floor and the top line of the roof, from other division lines, we put a triangular arrow on top of or underneath of the line, e.g.:

\[ \bigtriangleup \] : the line of the top of the roof

\[ \bigtriangledown \] : the line of the ground floor
In the analytical diagram of Fig. 4-4, the lines indicate the divisions of the facade which in reality represent the layout of the shape. In the cap, element , element , and element show different types of roofs. The first represents a regular type ended up with a horizontal line on the top. The second identifies a penthouse which is added on the top of the building and usually with a few feet set-back. The third symbolizes the type with no top line on it, meaning that the shape of the roof is irregular, usually with gabled shape.

Analysis IV - Systemization of the Analytical Facades

1. Rules for the Level of Basic Frame

According to Analysis III, we have seven basic frames for indicating the cap and the body of the facade. By looking carefully, we can find they are generated by three elements:

1.) 2.) 3.)

These three elements basically can be used to generate the seven frames we got from Analysis III. For instance, body 2 is composed of and , cap 7 is and , and cap 6 is and . Besides, the cap or the
Fig. 4-4 The Hierarchies of the Analytical Facades
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body could be the element itself. Therefore, we find two operational rules for making the cap and body, one for uniting with the elements of one kind, and another one for combining with two or three different elements. (Fig. 4-7) Following these two operational rules, we have variations for the cap and body of the facade. However, in real situation, we only get two categories for the body, which are \( I-I \) and \( I--L \). Hence, we have to exclude some combinations according to our common sense of designing. For instance, literally, the main body contains only one “body” and many divisions can be made inside of it, thus, there will not have the combinations of \( I_i - I \), or \( I_i - I \) because of their containing two separated parts. As for the cap, there are many combinations that can be made by applying the two operational rules. The only exclusion is that the element — can not be applied to the rule of uniting with two same elements.

When applying the rules for deciding the body and the cap, we simultaneously have to consider the height and the width of the facade. Namely, the moment we choose the elements to operate the rules, the height and the width of the building have been considered, which help the designer start constructing the frame of facade. Thus, the rule follower should decide, in this process, the number of the floors to be developed and the width as well. For the height, to maintain the continuity of urban space, we constrain it to three stories.
as the minimum and six stories as the maximum. Namely, rule follower should decide the height by using the number of floors for determining the outline of the facade. As for the width, it is usually determined by the narrow side of the lot which can be set up in the dimensional system.

2. Rules for the Level of Baywindow

After deciding the frame type of the facade, the next level is about the type of baywindows and their relationship to the facade. In this thesis, I take baywindows as a detached element to the building and use rectangle as an analytical tool accordingly to illustrate its abstract form. The rules for arranging baywindows are the sub-rules relating to the operational rules we have made before. In Figure 4-8, we show the rules and their existing instances. (Fig. 4-8)

Basically, we subdivide them into three categories: the non-divided, two-divided and three-divided, and apply them to horizontal and vertical direction individually. Accordingly, we can have the matrix of nine combinations, which mostly covers the variety of the arrangements we have analyzed. In Fig. 4-8, we use rectangles as an abstract symbol to imply the form of baywindow, thus, in the process of following the rules to design a facade, the facademake should take
it as a reference rather than picture it as a part of facade.

The rules in this level is to decide where the baywindow should be arranged. Among those rules, if the retangle fits inside the box, which is full-sized, then we can simply put it as the rule indicates. If the rectangle does not fit inside, meaning it only occupies a part of the box, then we can place a division line inside, usually representing a stringcourse or a line used as an interface between the area of baywindow and non-baywindow. Accordingly, when applying the rules in this level, we will not only see the baywindow inside the box, but also could have a division line simultaneously.

Baywindow is not a necessary element of the facade. One can choose not to have it in the decision-making process. In doing so, the rule follower only have to skip to the next step.

The rules in this level shows the relations between the baywindow and the body, which we simulate the shape of baywindow as geometrical form for the convience of describing. In reality, this spatial configuration does not account for the proportion of the facade or the precise dimensions of the height and the width. Considering the practical situation, we will set up the dimensional system in later section.
Fig. 4-8 The Rules for the Arrangement of Baywindow
3. Meta-rules

After setting up the rules for the basic frame and the arrangement of baywindows, we further give division rules for finishing the shape of baywindows and the arrangement of windows, entrance door and stairs. We name the rules as meta-rules, meaning the sub-rules after the basic rules. Figure 4-9 lists the rules and their instances as well.

Referring to the design process, up to this level, we have to decide where to put the windows and entrance door, or whether there should have an entrance stair or not. The rules we list in Fig. 4-9 are the decision-making rules about how many divisions inside the sub-divided areas or baywindow should be made, which indicate the arrangement of windows, stringcourses, and entrance doors. In this thesis, we assume that rule-player should have common knowledge about the process of designing, such as they should know a facade basically consists of windows and entrance door. If there is no entrance door, people will not get into the building, and if there is no window, the inside building will not have natural light coming into, which is hardly seen in most cases.

The rules we have here are defined according to the number of division. They are indicated by lines or rectangular boxes. The difference between the two is the former tells not
Fig. 4-9 Meta-rules
only the division of the area, but also shows where lines sit among the divided areas, while the later does not have lines in between. Besides, the vertical divisions can indicate how many floors of the building is contained.

Summary of the Rule System

In what follows, we will summarize the analysis to account for the rule-making process. Basically, there are three stages for the rule-making of the facade. First, the establishment rules determine the outline of the facade, such as what kind of body and cap should be chosen. Second, the development rules decide whether there is a baywindow or not, and if there is, what kind of arrangement can it be made. Third, the elaboration rules makes decision about where the entrance door is to be placed or how many window can be arranged, and so on. In addition, after finishing following all the three-staged rules, the player got an framing structure for the facade. But to complete the facade with details, we still have one step to follow. This step is to fill up the facade with building decorations, like lintels of windows and doors, and stringcourses. Also, the material of the facade can be chosen according to the rules. The rule-players should follow the rules on step-by-step basis and can only apply the rules of each stage to each level.
during the process.

In Figure 4-11, I show a diagram to account for the procedure of going through the rules. Basically, the ultimate goal of this rule system is to generate the type of BackBay's houses with variations. The concept of making it is by taking the existing facades to analyze the inferable relations among elements and to deduce these relations as a logical way. In addition, the rules should be productive in an architectural sense. In short, a set of generative rules should be developed in a productive system and a deductive system as well. In Figure 4-12, the illustration shows the rule test for the facade-making which accounts for the feasibility of the rule system. (Fig. 4-12a, Fig. 4-12b)
Fig. 4-11 Facade-making Procedure
Fig. 4-12a  Rule Test I for Facade-making
Fig. 4-12b Rule Test II for Facade-making
The Analysis of Details and Dimensional system

In this section, I show the physical elements to guide designers who produce the facades. Namely, the elemental lines, after finishing the framework of the facade, can be transferred to a real situation. To begin with, I generalize them into several instances where I consider them to be frequently used. And then, I try to give a general rule to fit the physical elements in the design by adapting the present material and construction system.

Generally speaking, the elemental lines of body represent the width of the facade and in reality they are the lines to define and distinguish the range of the width from their neighbors. Usually, we can tell the edged lines from different materials or colors. As we mentioned before, we use a rectangular box to indicate baywindows. By applying to the facade design, in fact, only two vertical lines can be seen. These two lines define the width of the baywindow. When we try to subdivide the area of the rectangle by using meta-rules, two kinds of baywindows are defined: one is split by vertical lines and the other one is by horizontal lines. The former represents the baywindow with the shape of two obtuse angles, and the latter means the shape of semi-circle. (Fig. 4-13)
In cap \( \underline{\underline{\text{I}}} \), the bottom line represents the shape of cornice. In most cases, it ends up with a number of parallel lines which are the profile with different depth. And beneath the bottom line of them, a row of details are attached in equal distance to the line. Accordingly, we set up the rule for it. (Fig. 4-14) As for the two vertical lines of \( \underline{\underline{\text{I}}} \), we also show them in Fig. 4-15. The difference between cap \( \underline{\underline{\text{I}}} \) and cap \( \underline{\underline{\text{J}}} \) is the top line of the roof which the former shows a horizontal line sitting on it and the latter usually means pediment with a variety of shapes. (Fig. 4-16)

The lintel of the window, in the facade, presents a variety of types which give us the sense of visual richness. In Fig. 4-17, we illustrate how the rules can be generated.

**Dimensional System**

In Figure 4-18, we set up three modules for the width of the facade, which are 18 feet, 24 feet, and 30 feet (Fig. 4-18). These three sizes are chosen to be used as the modular system which are frequently seen in the existing cases. Although there are more than three kinds of sizes for the width of facade we use them as a reference because they can cover a high
Different Materials

w : wide ban  n : narrow ban

n should be placed in the position of odd number
w should be in the even number.

Fig. 4-14 Rules for the cornice

Fig. 4-15 Rules for two edges of the roof
* Shaded area is the range that lintel can be placed.

Fig. 4-17 Rules for the lintel of the window
percentage of the dimensional system in the facade. Generally speaking, eighteen feet to fifty feet is the range for the width of the facade in BackBay. In setting up this modular system, three feet is a basic unit that generate the three sizes mentioned above. In Fig. 4-19, the illustration shows the dimensional relation of baywindow and the width of the facade. (Fig. 4-19) For the convenice of discussion, we only show three sizes as examples.

Rule Test

In the following illustrations, we show two cases which we ask three people to design the facade for Back Bay by applying the rule we generate. (Fig. 4-20)
Fig. 4-19 Dimensional System of the Facade
In floor plan, most of the houses were converted to multi-unit apartments which the partitions of their interior spaces were altered, or the functions of the spaces adapted to different uses from the originals. Because of the large number of houses, the plans I can obtain are limited. However, the plans in general are typical as a row house type, which their local characteristics of architecture is not very obvious. Therefore, I choose ten cases as examples to generate the rules for making plans. The goal is simple: to generate plans that can show the main structural system of the building, meaning their bearing walls and stair cases and columns (if any) will be defined according to their relations in spatial arrangement.

Analysis I - Plan Analysis

According to our reading of the floor plans, we classify the interior spaces into seven categories:

S: staircase
R: Room, including living room, dining room, reception space, bedroom, library and drawing room.
BA: bathroom
K: kitchen
C: closet, storage, laundry room
E: entrance space, including entrance hall
Rf: roof

In the following analytical diagrams and floor plans, we make analysis of the plans according to the spatial relations in terms of their functional arrangement.

From these analyses, we split the plan into three zones: two sunny zones and one shaded zone. (Fig. 5-11) For the sunny zones, usually living room, bedroom, or dining room are arranged in both areas, and staircases are put in the shaded zones. Within each zone, spaces can be separated horizontally or vertically, or any one of the spaces can be attached inside each zone or split area. Usually, a bathroom and a kitchen can be attached to the corner of a bedroom, or storage spaces to a stairway. Accordingly, we set up rules for arranging the interior spaces of the floor plan.

**Rule 1**
*R should be placed in both sunny zones, but dining rooms are excluded.*

**Rule 2**
*S should be placed in the shaded zone. Usually there are two stairways in one building.*
Fig. 5-1a Plan Analysis
Fig. 5-1b Floor Plans

85 Marlborough Street

5th Floor Plan

4th Floor Plan

3rd Floor Plan

2nd Floor Plan

1st Floor Plan

Basement Floor Plan
Design Rule III - Floor Plan System

86 Marlborough Street

Fig. 5-2a Plan Analysis
86 Marlborough Street

4th Floor Plan

1st Floor Plan

3rd Floor Plan

Basement Floor Plan

2nd Floor Plan

Fig. 5-2b Floor Plans
Fig. 5-3a Plan Analysis

157 Newbury Street

4F

R

H

S

R

3F

R

H

S

R

1F

R

H

S

R

BF

R

H

S

R

2F

S

C

R

S

R

R

R

S

S

C
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157 Newbury Street

1st Floor Plan

2nd Floor Plan

3rd Floor Plan

4th Floor Plan

Basement Floor Plan

Fig. 5-3b Floor Plans
167 Beacon Street

Fig. 5-4a Plan Analysis
167 Beacon Street

Fig. 5-4b Floor Plans
Fig. 5-5a Plan Analysis

265 Commonwealth Avenue
265 Commonwealth Avenue

Fig. 5-5b Floor Plans
Design Rule III - Floor Plan System

357 Beacon Street

Fig. 5-6a Plan Analysis
357 Beacon Street

Fig. 5-6b Floor Plans
Fig. 5-7a Plan Analysis
375 Marlborough Street

Fig. 5-7b Floor Plans

5th Floor Plan

4th Floor Plan

3rd Floor Plan

2nd Floor Plan

1st Floor Plan

Basement Floor Plan
Design Rule III - Floor Plan System

401 Commonwealth Avenue

Fig. 5-8a Plan Analysis
401 Commonwealth Avenue

Fig. 5-8b Floor Plans
Design Rule III - Floor Plan System

Fig. 5-9a Plan Analysis

412 Beacon Street

5F

4F

3F

2F

1F

BF
412 Beacon Street

Fig. 5-9b Floor Plans

1st Floor Plan

2nd Floor Plan

3rd Floor Plan

4th Floor Plan

5th Floor Plan

Basement Floor Plan
488 Beacon Street

Fig. 5-10a Plan Analysis
488 Beacon Street

Fig. 5-10b Floor Plans
Rule 3

E can only be arranged in either first floor or basement floor. But for the first floor, entrance should be in the front street side, while not necessarily for the entrance of basement floor.

Rule 4

Rf should be placed on the top of the building either combining other spaces or not incorporating any of them.

Analysis II - The Analysis of Spatial Units

In this section, we list interior units based on Analysis I to demonstrate different types of units. (Fig. 5-12) Basically, the shape of each unit is determined by the number of its openings and where the openings are located. For stairways, we have three runs, two runs and straight types. The shapes of the storage space and hallway are irregular which are difficult to define their types, they are usually shaped according to the spaces adjacent to them.

We also propose the dimensional system for the units which is based on three modules we set in the facade system.
Fig. 5-12 Different types of units
Basically, three feet and eighteen feet is the unit dimension and variations can be generated by following this system. (Fig. 5-13)

By setting up the dimensional system for the units, we can apply it to the three divided zones. Namely, within the divided zones, one can subdivide the areas with the modular system, which allow the flexibility for each zones and meanwhile the main structure can be kept. (Fig. 5-14)
Fig. 5-13 Dimensional System of the Units
Chapter 6 Type and Design Rules

On Type

Since the eighteenth century, there has been a tendency to regard the age of "primitive" humans as a golden age in which humans lived close to the nature. For many years, the primitive hut or one of its derivatives have been taken as the starting point for architectural evolution. In architecture, the Modern Movement was an attempt to search for a representational system on returning to the nature, which had been inherited from the preindustrial past and which no longer seemed meaningful within the context of a rapidly changing technology. This idea brought about the concept of type. The first coherent and explicit formulation for the idea of type in architectural theory was developed by Quatremere de Quincy at the end of eighteenth century, precisely at the time when the traditional "discipline" of architecture has been thrown into question by emerging social and technological revolutions. For Quatremere, the concept of type was intimately related to "need and nature." For example, the shape of a human's back must provide the type of the back of a chair, and the round shape must itself be the only reasonable type for the headdress. The type was in this way identified with the logic of form connected with reason and use. However, throughout
the nineteenth century, the idea of type was applied in exactly the opposite way, is compositional.

Composition is the tool by which the architect deals with the variety of programs offered by the new society; a theory of composition is needed to provide an instrument capable of coping with a diversity of built form that can be reduced to known type. The idea of composition is directly related to needs; its relevant criteria are convenience and economy. According to Durand who is, architect arranges the elements - columns, beams, foundations, and so on - which have taken form and proportion through their relationship with material and with use. The architect’s task is to combine these elements to develop more complex entities. At the beginning of the twentieth century, the theoreticians of the Modern Movement rejected the idea of type as it had been understood in the nineteenth century, for to them it means a set of constraints imposed on the creator who would like to be able create the object freely. Therefore, the nature of architecture is considered to be changed. Architects looked to the example of scientists in their attempt to describe the world in a new way. Mies van de Rohe is the architect who reflected this new idea on his work and, without being disturbed either by functions or materials, he was considered a builder of form-space. For him, a type of space is the structure that the architect copes with in reality, rather than merely dealing with
the type of architectural objects.

Modern Movement architects also wanted to offer a new image of architecture to the society that produced it, an image that reflected the new industrialized world created by that society. This meant that a mass-production system had to be introduced into architecture which would replace the image of singularity and uniqueness of the traditional architectural “object”. Accordingly, the word type was transformed from an abstraction to a reality in architecture by virtue of the industry. In that sense, type had become prototype.

But there was another argument against the nineteenth century’s concept of typology which was provided by functionalism. Functionalism was mainly concerned with method, who seemed to provide a unique resolution and to pose against the idea of a common structure that characterized type. Architecture was predetermined not by types, but by context itself. Therefore, functionalism deliberately rejected typology.

By discussing the concept of type on a city scale, a new series of writings began to appear in the 1960s which called for a theory to explain the formal and structural continuity of traditional cities. The authors saw the city as a formal structure which could be understood through its continuous his-
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The idea of type demonstrated a continuity among the different scales of the city. This approach proposed a morphological method of analysis for understanding architecture, which has formed the basis for a continued development of typological studies. By taking this notion, the most systematic and complex theory was developed in the works of Aldo Rossi and those in his circle. For Rossi, the logic of architectural form lies in a definition of type based on the juxtaposition of memory and reason. And according to Rossi, because the city, or its builder, have lost their own memory and forgotten the value of the primary and permanent types, the task of architects today is to contribute to their rediscovery.

The Concept of a Type-based Design

Then, what is type to architectural design? When architects start to design their projects, do they think about a kind of type which have been embedded in their minds? For architects always have learned from precedent, type of forms, in a sense, becomes a referential tool to solve the design problem. In architecture, architects need to express their ideas and deal with the complexity of problems. Therefore, without sharper tools of analysis and classification, the architect tends to fall back on previous examples for the solution of new problems - on type-solutions. This is also the search for the
design methodology and for the process of design as a branch of the wider process of problem-solving.

In designing, the intentions of the design process are hidden, and the intuitive, flashlike idea for the creation of design remains unknown. Design method, therefore, is a way to establish a system in the operation of designing to help the designer approach to the realization of form-making. However, our senses of places and relationship in an urban environment, or in a building, are not dependent in any objective fact that is measurable; they are phenomenal. The structure of the system that designers are looking for cannot be developed as a representational system to be dependent upon the quantifiable facts of the environment. It should be the system which is in a socially recognizable way. If we see the discipline of design is a mystical belief in the intuitional process, will the scientific technique be able to solve the problem? As long as our classification techniques were unable to establish all the parameters of a problem, it might be necessary to use a typology of forms to fill the gap.

Type is the spatial form to consolidate social agreement. It shares the image of built forms in a social body. As we see the houses in the Back Bay area, the image of the house type is shared by people with common experience. It is the sharing of forms that emerged through a long course of evolu-
Designing A House Typology

tion, which never conceptualized by anyone. Thus, if we can describe a type by the way of a structured system, the type, in design process, would provide an explicit approach for designers to follow. The type has the power to unify the complexity of design problem and make it accessible. The type of forms need not be based on formal science, but there is always a body of knowledge shared among the designers and those they must work with.

Design Rules

Accordingly, how can a type be described in a systematic way? What is the way that design method can be generated in terms of the type of forms? In order to learn from the type of forms for design practice, we organize the systematic rules in the type, which are in fact design rules. Rules reflect decisions that a designer must take to arrive at a instance of the type. For designing is not a random behavior, it must be guided by certain rules. To present all of the instances of the type does not describe the type in fact. A type consists of a particular collection of forms that constitute a “family”, which all forms bear resemblance to one another. To describe a type therefore means that we have to manage the balance between constraints and choices: the former makes sure the similarities and the latter offers freedom of being different. Rules allow us
Type and Design Rules

to make choices with a certain degree of constraints.

In the rules for facade making, we take the abstract language - division line to describe the rules. By following the hierarchical steps, designers can have choices for every stage of design process. These choices have to be made by using the elements which can be distinguished by designers, and the relations among the elements. Namely, the rules are about the selection of elements and arranging their relations. Theoretically, the generated rules should be able to replicate any given instance of the type and provide the variations of it.

In this design rule-making, basically I express the idea about what is the type of Back Bay's houses. However, we do not attempt to translate the architectural style by virtue of the rules, although type itself usually involves the interpretation of its own culture. Rules are generated to present the formation of the type instead of describing how the type is translated to be a certain kind of style. In addition, rules are the explicit way for people to communicate with each other in reaching the type they all agree upon. This is the function of rules that can help designers to deal with the implicit.
In introduction, I proposed to establish a rule system for designing the houses of Back Bay, which I assume that by following the rules, the design quality of being similar to Back Bay's houses can be maintained. I believe that design rule is an efficient way to achieve this scope. However, a primary question might be raised: Why achieving the quality of the house type in Back Bay? As I mentioned in the Chapter 2, the development of the Back Bay Area started with the need of searching for the new land to keep away from the getting-crowded old city center. Therefore, Back Bay was developed with the intention of creating a new spirit of Boston. In fact, the planning of this area was practically controlled by the property restrictions set down by the local Building Department. (Fig. 7-1) This reason explains one of our motivations to generate rules to maintain the quality of this house type. Rules, on the one hand, constrain the freedom of followers and they, on the other hand, allow for the differences in designing the house type. A set of well-established rules provide the choices in making decision and can leave choices open to the rule followers.

In the process of making design rules, although I set up the goal of which the rules can be reached in designing facade,
floor plan, or urban block of Back Bay, another issue related to the process of designing is also brought up. Because the design rules are generated according to people’s perception of observing the physical form of the study case, I frame the range of what are the rules should restrict. There seems no limit for this restriction. However, as designers, we understand that architects create forms with the “hidden” process in their minds and they always require more freedom for their creativity. Therefore, what the bottom line we can draw for the design rule-making is an argument between the rulemaker and the rulefollower. Even when the agreement of rules is compromised by both sides, we still are questioned all the rules whether can be generate the house type of Back Bay. Can the rules be applied to generate the house type which is not expected as a result? How can we judge the designed house on whether it represents the quality of Back Bay’s house or not? Or, how can we examine the rule system that does not miss the rules that also can be applied for the purpose?

By thinking on these questions, it seems that we are standing on a new startpoint about searching for the answer of what is the nature of rules. Nevertheless, each rule of the rule system has its own intrinsic value which deserves further
exploration. Instead of merely making efforts on establishing perfect rules, we would rather start formulating a rule system for designing a house type to explore its potentials. However, this attitude keeps us consistently perceiving the nature of design and its limit, until finally further efforts toward building a formal rule system of designing can be achieved.
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Bibliography

THE MAJOR READING ON WHICH THIS STUDY IS BASED

ABOUT TYPE


ABOUT BACK BAY


ABOUT THE METHODOLOGY IN GENERAL


