DESIGN RULE MAKING:
A Study of Hawhoe Houses in Korea

by

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Abstract

A set of design rules is suggested and explored to understand the design process and conventions in architecture. By providing an environment which is manipulable and conditional, design rules can disclose the nature and meaning of the system the rules have. Moreover, by making and playing with a set of rules, we are directly exposed to design activities as well.

In order to make design rules for a certain architecture, we have to figure out an essence of agreements that constitutes the conventions on which the architecture is based. Although conventions do not explicitly reveal specific rules or elements in architecture, we may read and write more clearly about what we find critical in them. In this thesis, they are described and tested in terms of design rules.

The subject of the rule making is a group of traditional houses in a village called Hawhoe in Korea. Although they are vernacular architecture with anonymous architects, we can find certain themes common in them, because they are the product of the conventions of the time and place. Design rules are those that guide the design of the houses reflected as variations of the theme, and those that explicitly or implicitly followed by people engaged in the design. After scrutinizing the classifications of the design rules, a set of design rules is proposed based on my reading of the theme, and tested through simulations by several people of diverse backgrounds. The process and its result shows not only that we can make critical design rules from existing vernacular architecture, also it is possible to reproduce a set of new rules, based on the old one.
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1. Introduction

1.1. Context of Designing

Several years ago, I was involved in a project of building a small traditional house in Seoul, Korea. The House was built by an old head carpenter named Eum, following the traditional specifications and making use of the second-handed material collected from a couple of decomposed old houses. Yet, there were some modifications made. The kitchen, which used to have an earth floor, was elevated to the level of the other rooms and paved. A dining room, which we can not find in the traditional house, was added according to the request of the client. The traditional heating system was also changed into a modernized panel-heating by piping, not by smoke channels underneath the floor.

Observing the construction of the house, I noticed two facts. One is that the construction was quite systematic, coping with the changes of time-new material and equipments. The other is, while I was talking with Mr. Eum, the head carpenter, I found that he did not refer much to the drawings. Though he was familiar with modern drawings, he read and made it his own version of blueprint. During our conversations we would sit on the ground; the tool used to draw was a stick. We had drawn a number of drawings similar to those which we can find in an old geomancy book.[Fig.1] The argument was
started from the siting and orientation of the building, and then went into the distribution of rooms. The result satisfied everyone involved in the project, though it took longer than expected.

The experience shows not only that we can build a house from a simple line drawing, but that there is both a tremendous amount of conventional knowledge as well as systematic rules pertinent in architecture. A drawing in dirt contains the abstraction of design. It shows how the structural system is organized, what kind of material is used for which rooms, and how the whole shape of the building looks like. It seems clear that the way the old carpenter approached the design was quite different from that which we learned in school. The question is, then, how do we understand the different perspectives of the design process and what can be learned from traditional houses.

The idea of game, thinking about rules and playing with them, would be one of the ways to answer these questions. If, with a handful of rules, we can simulate these possibilities, we can get a new vision and introspection of our architecture as well as design itself. What I am trying to explore in this thesis is, therefore, a making of these rules and an understanding of this process of design.
1.2. Context of the Game

The scope of my thesis is to make design rules for a group of traditional houses in Hawhoe village, a historically preserved village in Korea, and to see how it works. If we can find a common 'theme' in these houses, we may assume that there is a kind of system common in the houses and that people have built and maintained them under the guideline of the rules of the system. The design rules are those that guide the design of the houses reflected as variations of the theme, and those that explicitly or implicitly are followed by people engaged in the design.

It is not quite like making rules for a game, but it resembles the game partly because it has a set of rules that people can follow and play, and partly because the simulation of the rules is not a part of reality but a self-sufficient and playable set of possibilities within a limited analogy to reality, just the same as the play in a game. Therefore, the rules I am suggesting in this thesis are the rules of my reading and writing on specific artifacts, namely the three Hawhoe houses.

There are two objectives for studying design rules about the Hawhoe houses. The first one is to learn more about the nature of design. By making design rules and playing with them, we expose ourselves to the diverse setting of the design world.
We may not have to deal with a whole design project; we can pick up certain stages of design and explore them without thinking much about functions or images. Like a ‘language game’ or a ‘design game’, making and playing with rules can disclose the nature and meaning of the system the rules have.

The second objective is that, by rule making and playing, we can get a better understanding of architecture. Especially, in the case of vernacular architecture, we may easily recognize certain familiarities, but they seldom express themselves explicitly. The rule making and playing is, therefore, one of the best ways to describe and learn about that kind of architecture.

Rule making is a part of abstraction, just as design is. Designing always engages in an abstraction of something, not only because it is impossible to describe everything about our design, but also because our frame of mind does not serve to read two things or more at a time. Thus, what we need is more simple and explicit design rules.

Since artifacts are products of conventions, in order to make rules we have to deal with the conventions and externalize them in a certain way. But, the conventions are hard to grasp. In the case of vernacular architecture, moreover, we are
bewildered as well as fascinated by the vagueness and implicitness of the conventions. They do not have Ten books or Four books on their architecture, nor explicitly represent rules and elements of the architecture. They have changed over time but still something remains. Because of the arbitrariness inside, it is difficult to clarify those conventions in the light of design rules. Like a particle of uncertainty, once finding its existence but losing its location, the essence of conventions seem to evaporate, when we externalize conventions.

However, that does not necessarily mean that the implicitness is the only face of convention. The danger of implicit conventions always remains, when we take everything for granted and ignore the essence of agreements that constitute conventions. Since they do not disclose themselves, in order to understand more about conventions as well as our built environment, we have to read and write more explicitly about what we find critical in them. Here, they are described and played in terms of the design rules.

In thinking about design rules, there is an area which was not initially included in this thesis, but later I found extremely interesting and put in the thesis as a separate chapter - the simulation part. In design, we are facing the two processes: one is abstraction from the object, the other is materialization towards the object. Since our interest is generally focused on
the first process, we used to neglect the other side of the coin, which is still of importance. The danger is always that we regard the tools of abstraction, such as diagrams, geometry, and design rules as well, as being the absolute goal of design. Without a proper decomposing structure inside, which is rather implicitly represented as plays of game in this thesis, the very explicitness of abstraction may be found disadvantageous to designing instead of supporting the design process; it is the means not the end of design.

Consequently, this is a study of the design process and conventions in architecture, and about the design rules as well as the Hawhoe houses. I follow the procedure by taking the first step to clarify the nature of design rules and to suggest some classifications about them. Then, from the three houses, I extract and assume a set of design rules based on my reading. The last step is testing the design rules by playing with them. Although the simulation is limited to few plays, it can be another first step towards the exploration of the next design world.

The thesis is composed of six chapters. Following the introduction chapter, the character of system and rules are discussed in Chapter 2. The first section introduces the idea of system and variant, and the following section explores the
definition of design rules and sketches some difficulties in reading and writing the design rules, and how they are related to the simulation. The last section is about the classifications of the design rules. I suggest two different design rules in terms of two categories. The first category is about the scope of the design rules and the second is based on the type of relations that the rules contain. The design rules, according to the first category, divided into more general *Initial design constraints* and more specific *Strategical design rules*. By the second, some are *Typological design rules* that deal with relations between the whole and parts, and others are *Techni-cal design rules* that concern the relations between elements.

Chapter 3 is the description of the context in Hawhoe houses and the reasoning behind choosing the subject. In Chapter 4, the overall design rules for the Hawhoe houses are discussed, according to the classifications of the design rules discussed in Chapter 2. Those design rules are tested and played in the following chapter as a form of simulation. In Chapter 5, thus, four examples of the simulation are listed followed by short reflections on the plays.

The final chapter is the conclusion. From the discussion of the design rules, we can find that the rule making process is a way of understanding design as well as our built environment. The design rules provide people with insights towards the design
process and the understanding of architecture, and they reveal a vision towards the next agreements - new rules for design. The study of the design rules shows that a new set of rules is always possible. While practicing rules, people add, delete, reinforce and modify some of their own. Therefore, rule making from the existing artifacts, eventually, will provide the ground for the new, as it always has been.
2. Design Rules

2.1. System and Variant

The conventions we are talking about here are conventions of using certain elements and not others, or arranging such elements in a certain way but not otherwise. No matter that we do it for practical reasons, for beauty, for fashion or by scientific principle, in all cases we choose certain parts and certain arrangements and reject others. That means we are choosing a system. Thus in all artifacts we can find thematic systems.¹

Every designer has his own view of the world and can express his individual freedom in design. In fact, however, he has never enjoyed complete freedom in design. There have always been some kinds of constraints or regulations within the world he designs. While some constraints are rather explicit and specific (such as square footage of area required, cost of construction, building codes and regulations, and so on), others are less explicit and more general (such as style, traditional and cultural conventions, and so on). In any case, design is a negotiation process between individual freedom and immanent constraints within the boundary of social convention. No form of architecture or artifact in the built environment can be totally independent of the material, economic and social conditions of its time.

¹ N. J. Habraken, The Appearance of the Form, 1985, p. 78

If form, the main protagonist of architecture, is neither fully
determining nor determined, then how do designers cope with the freedom and the constraints. Although in designing, we cannot know how beforehand what the design will turn out to be, we can find or at least describe certain systems within the conventions of built environment, in which specific elements are related to each other according to specific rules. For the understanding of our complex built environment, it is necessary to find systems and rules that are common to its artifacts.

The SAR Methods introduced the concept of ‘theme’ and ‘variation’.

The SAR approach sees the environment as based on systematic rules that incorporate a ‘theme’ which can be recognized by the observer. Each intervention can be a ‘variation’ on this theme. The terms suggest an idea that the environment can be described as a system in which specific elements relate to each other according to specific rules. In dealing with built forms and spaces, John Habraken, one of the founders of the SAR, uses the terms systems and variants, “when there are formally expressed rules within a clearly determined procedure”, comparing to theme and variation which can be used, “when the situation is more informal and rules are implicit.”

Every artifact can be read as a variant reflecting its system, or to put it in Structuralistic terms, it can be seen as an event which reveals its pertinent structure. It is interesting to note

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2 SAR is the initial of the Stichting Architecten Research (Foundation for Architects' Research) which was founded in 1965 in the Netherlands. Initially, the SAR method was aimed at designing housing structures based on the systematic formulation of design decisions by way of ‘agreements’. Later, the method introduced the concept of ‘theme’. See SAR 73, 1973

that Lévi-Strauss defines art as one which lies half-way between scientific knowledge or what he calls the ‘engineer’s mind’ and mythical thought or the ‘savage mind’.

It is a common knowledge that the artist is both something of a scientist and of a ‘bricoleur’. By his craftsmanship he constructs a material object which is also an object of knowledge. We have already distinguished the scientist and the ‘bricoleur’ by the inverse functions which they assign to events and structures as ends and means, the scientist creating events (changing the world) by means of structures and the ‘bricoleur’ creating structures by means of events. 4

Like art, architecture is somewhere in between two poles - scientific knowledge and mythical thought, where systems make variants and variants introduce other systems; where the former is a process guided by rules within systems and the latter is a way of accumulating rules for systems.

What I am trying to explore in this thesis is a kind of trip between two poles. The starting point is bricolage. From the existing artifacts I will extract a system which can be represented as a set of rules. Then, from the set of rules, a different but a certain family of artifact can be brought about. The first step is called Rule Making and the next name of the game is Simulation.

2.2. Reading Rules

The word "agreement" and the word "rule" are related to one another, they are cousins.

Literally speaking, rule means 'law or custom which guides or controls behavior or action'. The notion of rule implies a power governing the body. We may say if the power is strong, the control is relatively strict; if not, it is more or less loose. What matters in 'following the rule' is an implicit agreement. When players do not agree with each other, they cannot play the same game. In a ball game, we often see the argument between the interpretations of rules and regulations. In designing artifacts, rules are usually not so explicit as in the ball game, and they are largely described as design constraints. Yet, if we were to make any significant progress in designing, we need agreements. In this thesis, these agreements are called design rules.

Making rules about something we see is a way of reading such rules in it. Design rules can be formulated from various perspectives. Actually, in the form of the built environment, what we can find are not exactly systematic rules but facts of agreement between powers involved in design, which means that the rules can be changed at any time. This liveliness of the design rules is not easy to grasp. One the one hand, since it is based on implicit conventions, every form has a certain degree

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of arbitrariness which does not tell us whether the rules made are always valid or not. On the other hand, a list of possible rules in a group of artifacts is potentially endless. There are also numerous ways of describing relations.

However, we are not dealing with the system of a machine. For example, in an arithmetical series or function, if one knows the rule of a series, one can apply the rule and produce a segment of a series, which is different from architecture that has the system with human interventions and that has the rule not absolute. Thus, this system certainly allows us to read the rules for design in terms of our ruler. In fact, architects or builders or bricoleurs always have made judgements based on the internal or external agreements for their design. These are the kind of rules we are looking for, and these are the rules that have the significance and meaning in design, although they may be broken at any time, when there is enough justification and agreement about such violation among the people involved in the design. These rules can be called, therefore, critical rules.

The reading of critical rules in artifacts starts with shrewd observations and puts forward a hypothesis that should sufficiently and satisfactorily describe these agreements. If we can get to a coherent system in which basic elements are structured in crucial relations, then these are the critical design rules, the rules of the game we can play.
Design Rules

2.3. Writing Rules and Simulation

What do I call 'the rule by which he proceeds?' - the hypothesis that satisfactorily describes his use of words, which we observe; or the rule which he looks up when he uses signs; or the one which he gives us in reply if we ask him what his rule is? - But what if observation does not enable us to see any clear rule, and the question brings none to light?7

The question about the design rules is, then, how do we write down the critical rules, and how do we know they are critical, if we have written rules. The first question is about the description and representation of the rules, and the latter is related to the idea of the simulation. In this thesis, the design rules are described in a written form classified accordingly to certain categories and accompanied by a set of abstract sketches to help in communication. The rules are carefully chosen after scrutinizing the information and the facts about the houses. It is the simulation that is used for verifying the rules as well as showing the examples and possibilities of the play.

Christopher Alexander is one of those who tried to write down a list of possible rules - more specifically, according to him, relations between a form and its context, and the way he studied suggests some clues to answer the above questions. In Notes on the Synthesis of form, Alexander found that, from a

7 Wittgenstein, Ibid., §82, p.38
purely descriptive point of view, "there is no way of knowing which of the infinitely many relations between form and context to include, and which ones to leave out." He coined the term 'good fit', a property of an ensemble comprising the form and its context, for the criterion of selection. Using a mathematical analysis, Alexander could organize a hierarchical diagram reconstructing a set of selected relations. However, he left problems of dealing with 'goodness' or 'rightness' in terms of design and their abstraction of diagram.[Fig. 2] It is hard to value whether a certain relation is 'good fit' or not. He skipped the fact that the 'good' is referred to as an agreement based on the conventions of the people. Considering that what we are trying to find out is the agreements- the rules that we can read in the existing artifacts, the design rules are the more viable concept than the 'good fit' relations.

Another important thing to notice here is that the idea of diagrams is used as a representation of these relations, which he later calls 'patterns', and that the idea has the danger of assimilating design with abstraction and ignores the role of the design act in terms of commitment by the people involved. The simulation, therefore, becomes significant in the design rules I propose, because it introduces the activity of people and is partly related to reality.

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* C. Alexander, *Notes on the Synthesis of Form*, 1964, p. 26
A diagram is, according to Alexander, ‘any pattern which, by being abstracted from a real situation, conveys the physical influence of certain demands or forces’. Even though he uses the term diagram in a wide sense, the power of representation in a diagram still lies in its abstraction. It delivers the formal characteristics of a physical structure.

However, Alexander underestimates the difference between the shape of mathematics (or diagrams), which are abstract, and the shape of architecture, concrete and human. The recognition of this difference is crucial when we deal with designing. When there is no longer a distinction between representation and reality, the value system represented through abstraction is no longer valid. When a diagram becomes an end in itself, the link between representation and reality is no longer relevant. It only reveals the emptiness of superficial clarity missing the essence of real life. The design as a diagram loses its power of abstraction. This was the case with many examples of modern architecture, which Klaus Herdeg called a ‘decorated diagram’.

Every designer uses some kinds of tool for abstraction in designing. For some, it can be a form of sketch or drawing, for others it may take another medium, such as the collage or the model. Without such tools, we cannot get to any concrete idea. There is no denying that the diagram is one of the best

\[9 \text{ Ibid., p. 85}\]
\[10 \text{ Ibid. in Epilogue, p. 134}\]
\[11 \text{ See K. Herdeg, } The \textit{Decorated Diagrams}, 1983, p. 77\]

Herdeg concludes that modern architecture under the influence of Gropius falls in decorated diagrams, compared to the other architecture done by Alvar Aalto and Le Corbusier.
ways to convey ideas into design, as long as it stays as a tool for abstraction. The design rules are, like the diagram, reductions of the reality. Thus, the simulation of the rules must re-establish the contact with the reality.

2.4. Design Rules

Practically, when we speak about the system guided by certain rules, three aspects of rule can be found: firstly, selecting particular kinds of elements; secondly, finding particular relations between elements; thirdly, following a particular kind of organizing procedures to arrange the elements in space according to the given relations. Wang, in his Ways of Arrangement, distinguishes the first two as the formal rules, which are about determining elements and their relations; and the third as the procedural rules, which are about sequences of doing things. However, when we explain rules of a game, we make a rough outline of the game first, then define the elements and their relations. These relations are in many cases interwoven with the elements, and are conditional and procedural. In this thesis, therefore, rules are written in a manner that do not separate the elements and their relations. Rather, they are categorized under various aspects of design rules.

\[12\] M. H. Wang, Ways of Arrangement, 1986, pp. 69-72
2.4.1. Initial Design Constraints and Strategical Design Rules

Consciously or unconsciously, designers are working under two levels of constraints and rules. The first level is general knowledge-based constraints. It acts as a guideline which leads to constructing a ground for the design world. The second one is more specific and generative, not general, rules that are especially made and chosen for a specific project. I call the first-level rule the *initial design constraints* because they are given at first hand, based on the conventions. The second is called the *strategical design rules*, referring to a specific goal-oriented idea.

Generally, constraints define a certain ground and limitation for a design, while rules are more about procedures of how to act accordingly - the rules of conduct. The distinction between the two is not always clear; the *initial design constraints* usually control the *strategical design rules*, though sometimes they are not related to each other. For example, four initial shapes of Korean vernacular houses are defined as one of the *initial constraints*, and, in the *strategical rules*, four building types for the Hawhoe houses are clarified based on those four initial shapes. There are also the *strategical rules* within the building types which have no connection to the *initial constraints*. 
If we are to make a linguistic analogy, the *initial constraints* can be referred to as grammar and the *strategical rules* can be considered as the use of words or sentences (in a rhetorical sense). They are not unlike the *langue* and *parole* of Saussurian linguistics. The *langue* is the system of a language, the language as a system of forms, whereas *parole* is actual speech. What is fixed is the *langue* and what is subject to free manipulation and change is the *parole*. This is based on the idea that the *langue* gives the individual speaker an infinite freedom of combination and permutation.

However, Alan Colquhoun argues that the system is reversed in architecture. "The individual designer", according to him, "finds a set of procedures and rules which incorporate a set of socially agreed upon norms." Therefore, in terms of design, the *langue* is reorganized based on collective *parole*, and the set of procedures and rules can be referred to and systematized as the *initial constraints* and the *strategical rules*, as kinds of intermediate form between the *langue* and *parole*. Colquhoun concludes that these rules constitute the typologically fixed entities within a social context.

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13 There is a fundamental difference between the system of language and that of language. According to Saussure, the starting point of his linguistics is that the sign is arbitrary and it is a purely relational entity. And, if we wish to define and identify signs, we must look to the system of relations and distinctions which create them. Therefore, this system of forms, called *la langue* is separated from *parole*. In dealing with forms of architecture, however, the combination of signifier and signified is not entirely arbitrary, and the sign is itself motivated.

See A. Coulquhoun, 'Historicism and the Limits of Semiology', in *Essays in Architectural Criticism*, 1981


15 See Coulquhoun, 'Introduction' to *Essays in Architectural Criticism*, 1981, p. 15
2.4.2.
Typological Rules and Technical Rules

We may think of the different division of the design rules based on how the rules are related to the design elements and form. Two kinds of design rules are possible in terms of the design process. One is the rules of organizing the whole or type: the **typological rule**. It concerns the relations between whole and part. Always referring to the precedent typology, it is a set of rules chosen to organize the whole. When an artifact can be seen as an instance of a type, we always conceive the type as a self-contained entity, as a whole. Although it is difficult to describe explicitly, it is certainly possible to make rough rules delineating the type. Thus, the typological rule tells us about the over-all structure, not about the individual elements, and basically is a top-down system.

Another one is the **technical rule**, which is more practical and functional. It is a rule about the specific relations between elements, a traditional concept of rule. Though it usually does not address the whole system, the technical rule can reveal the structure of the elements of a same level. The properties of materials and details are also represented in the technical rules. This is a kind of bottom-up system which has the possibility of creating a new type without the help of the typological rules.
A shape grammar has four components: a set of shapes, a set of symbols, a set of shape rules and a labelled shape called the initial shape. For the ‘shape grammar’, see G. Stiny, “Introduction to shape and shape grammars” Environment and Planning B 7, pp. 343-351 and other writings.


Also, Wang, Ibid., used the similar concept of rules and arrangements to characterize Usonian houses of Wright.

If the relations between elements can render a certain cohesive form, we may not need the typological rules in design. Certainly, some descriptive rules show that much can be done with the technical rules. ‘Shape grammar’ is one of the design languages that has descriptive rules, called ‘shape rules’. The shape rules are defined in terms of spatial relations between shapes.[Fig. 3] It has been shown that the shape grammar can specify and characterize a ‘style’, such as Palladian villa plans, the Mughul gardens, and the prairie houses of Frank Lloyd Wright. These grammars have an assumption that the shape rules, a kind of technical rule, contain the knowledge controlling the over-all shape. But they are not given explicitly in any of the shape rules. What is lacking is the concept of typology, or the typological constraints. If there is no typological concept in the rule, and if the designer has no intention, the system of rules only reveals a limitation that it can make any thing, but of neither use nor significance.
3. Hawhoe Houses

3.1. The Reasons

For the practice of rule making and playing, I will take three traditional houses from the village called Hawhoe in Korea as a case study. Before examining these houses in detail, however, I would like to lay out my thoughts on the reason why and in what context I took those houses for scrutiny.

First, they are living houses. The oldest is more than 300 years of age, but still has been maintained as a decent house. There have been tremendous changes: from monarchy through colonial imperialism to recent capitalist democracy. In the past, electricity and automobiles were not available to the inhabitants, now they watch TV and take the bus to Andong city. There were three classes in the social structure; the nobles, common people, and the servants. The class system has been completely dissolved for many decades, and along with the modernization many youngsters head for big cities and never come back. It seems that the houses might remain as antiques, yet, people still live there.

When we look into the history of any traditional or vernacular house, we can find that the house is never completed. During its history, the house is continuously changed. People extend their house or remove some part of it, or rebuild and attach
another building. In terms of design, these houses can be seen as a process which never ends as long as people act upon them. But, the problem is that we can not trace all the history they have. In many traditional houses, records of changes are hardly available. What we see in the house is the product of design at that time. Although they were built in different time periods, they have been transformed and are still standing there as a living body not as corpses. Now, we can deal with these houses synchronically. Diachronic knowledge should not be ignored, but what we are looking for is a shared structure and coherent rules between them. It starts from the facts - the reality of firmly standing buildings. Architecture is not a myth.

The second reason is that these houses share certain specific conventions. They are considered as a type of traditional house in Korea. In a first glance, we can recognize they have similar shapes and organizations. These houses have a distinctive courtyard inside. They are composed of certain kinds of buildings. They have tiled roofs and a similar wooden-frame structure. Though in detail, differences are found, these houses are certainly common in their over-all structure. The similarities in arrangements and configurations of space and material can reveal common rules of the structures, which are the subject of the study in this thesis.

According to Habraken, thematic systems are recognized by
observation of their variants, and the variants are the products of powers who follow certain common rules about selection and distribution. Here, the variants are the traditional houses which look similar to one another, nevertheless they are the same. By examining a series of the variants, the rules of selection and distribution can be found to explain their structure.

The third reason stems from the considerable discrepancies between the design of traditional houses and that of modern houses. The differences in design approach is even bigger than those in life style. Some people prefer modern houses simply because they are convenient. But in many so-called ‘designed’ modern houses, the concept of convenience is replaced by simple-minded interpretations of functions, which create houses purely in terms of functional relations.[Fig. 4] It seems we are losing not only the memories of what our houses were, but also the life and the value the houses contain. However, considering that there are people still living in traditional houses as well as in apartment houses, it is not impossible to revitalize the type of the traditional house in terms of contemporary life and sensitivity. The rules I am trying to make in this thesis, can be the first step to understand the traditional built-environment and possibly show the different concept of designing they represent.

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1 Habraken, *Transformation of the Site*, 1983, p. 38
The fourth and the last reason for taking these houses as a subject for study is that they are the main houses in the village. Each is built as an original house of the family from which the offspring branched. They can be referred to as, respectively, the eldest, the second and the third big brother of the village. Therefore, they differ from other common houses. On the one hand, they have more power and control over the structure of the village. They occupy the larger property and each has its own house name. They had the privilege of using round columns in the house, in spite of the fact that such columns were not to be used in residential buildings. On the other hand, these three houses represent constraints as well as freedom in design. Each house had enough power to realize whatever it wants. But at the same time, each has to show certain qualities: size, structural dimensions, spatial organizations, craftsmanship in details or whatever else it takes to be legitimatized as one of the traditional main houses. Therefore, these houses have turned out to be the most distinctive and complex artifacts in the village. After we understand more complex ones, it is not difficult to think of a simpler version. Likewise, the higher level of differentiation in these houses suggests the rules of more complex artifacts which can be propagated to less complex ones, but not the other way around.

3.2. The Village

Hawhoe village is located to the southwest of Seoul, near Andong city which is one of the old, large cities in Kyung-Sang-Buk-Do Province. The literal meaning of the word comes from the geographical conditions depicting the village; 'Ha' (河) means river and 'whoe' (囲) means something running around. The three-quarters of the periphery of the village are surrounded by the Nakdong River, one of the longest in Korea, which is in turn bordered by mountains. [Fig. 5] The only access way from the Northeast, meaning Andong city, is partly blocked by mountains and makes a long and winding road. Although it is surrounded by natural beauty, the village is literally isolated from the outside world. Based on its characteristic topography, according to Korean geomancy, Hawhoe village was said to be one of the four best places in Korea for generations to live in. In spite of the invasions from outside, including Japanese imperialism, post-war American commercialism and recent industrial modernism, the village is relatively well kept and preserved, owing a lot to her island-like geography. Several years ago, the access road to the village was widened and paved. Recognized as having the pristine quality of the traditional village, Hawhoe is now designated as an historically preserved folk village. Everything has remained as it was, except for a new parking lot and small souvenir shops. [Fig. 6]
The village is largely divided into two parts by the major access road in the middle; the northern part of the village is called ‘Buk-chon’ and the southern part is called ‘Nam-chon’. Each house is enclosed by walls and the same walls define the road as corridor-like public space. The roads are laid down more or less autonomously making loops, according to the topography, and connected to the main access road from the outside.

Hawhoe village is known not only as a place where human artifacts are in harmony with uncontaminated nature, but also as the home of Ryu, Seong Ryong(1542-1607), a famous prime minister of the Chosun dynasty. In fact, Ryu(柳) is the family name of the village. The majority of the households in Hawhoe has the same family origin and the same surname as the prime minister, although there are a small number of people, who used to work for the Ryus as servants or came from outside for work, having different surnames.

There is no record of when the Ryus settled in Hawhoe. However, during the seventeenth century, Hawhoe already was a fairly large village and the present structure of the village was supposedly established at that time. The village today holds more than 200 houses. The number of the houses, once around 300, has been decreasing.

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4 Ibid., pp. 50-53
3.3. The Houses

Hawhoe is a village of Confucian society. Confucian ethic has dominated the life of the village people. The social structures of the village are also reflected in the houses. Generally, the big houses are the homes for the main families. In the patriarchic society, the eldest son succeeds to all the power including the ownership of the house. The other offspring are
Figure 7. Locations of Four Houses: Yang-jin Dang, Chung-hyo Dang, Buk-chon Daek, and Nam-chon Daek.
supposed to have relatively small houses, but according to their affordability, they can build houses as big as the main one. The servant class used to occupy a part of the big houses or live in detached small houses next to the big house. After the dissolution of the class system, economic conditions played the main role in determining the size and the shape of houses. Wealthy families have houses with tiled-roofs and separate gate buildings and those who are not rich usually have thatched-roof houses, some of which are now renovated with tin roofs.

There were four major houses in the village. North village (Buk-chon) is represented by Yang-jin Dang and Buk-chon Daek, and South village (Nam-chon) by Chung-hyo Dang and Nam-chon Daek. Most are still remaining after years and members of the Ryus’ clan live in the houses except in the last one of which the main buildings burned down. The scope of my rule making is focused on the first three houses; Yang-jin Dang, Chung-hyo Dang, and Buk-chon Daek. They show qualities of authenticity and still are in good condition. The fourth one, Nam-chon Daek, will be used for the simulation of the rules. Since this house has only two small buildings, a gate building and a shrine, the house lot is almost empty except for some trees and shrubs. I present a reconstruction of Nam-chon Daek based on the design rules made for the Hawhoe houses.

\[\text{Kim, Ibid., pp. 82-83}\]
3.3.1.
Yang-jin Dang

Yang-jin Dang ( 양진당 ) is the oldest house in the village, and is said to have been shaped before 1600.6 The house has been the head house of the Ryu families from then on. It is located to the west of the village, and the general orientation of the building faces South. Across the entrance yard is the main gate which has the high roof. When we enter the outer yard through the main gate, we find the main body of the Master’s pavilion (Sarang-chae in Korean).7 To the left is a courtyard house for the Mistress called An-chae, and to the right over the wall is a wide open yard, the shrine yard, where the shrine building for the ancestor (Sadang-chae in Korean) is located. They say there had been another building in this yard, but not anymore. All buildings are connected except the shrine building. The house is now designated as a national treasure. [Fig. 8, 9, 10]

6 Chu, Ibid., pp. 149-153
7 For the architectural terms in Korean, refer to the glossary in Appendix 2.
Hawhoe Houses

From N. C. Chu, *Residential Architecture of Korea*

Figure 10.
Elevations, Yang-jin Dang

South Elevation

South Elevation through Courtyard

East Elevation

West Elevation through Courtyard
Design Rule Making: A Study of Hawhoe Houses in Korea

Figure 13.
Elevations, Chung-hyo Dang
From N. C. Chu, Residential Architecture of Korea

South Elevation through Courtyard

North Elevation

Figure 14.
Sections, Chung-hyo Dang

Section through Main Cndol Room

Section through Daechung
Figure 11.
Site Plan, Chung-hyo Dang

Figure 12.
Plan, Chung-hyo Dang
3.3.2.
Chung-hyo Dang

Chung-hyo Dang (忠孝堂) is located in front of Yang-jin Dang. The road dividing these two houses is the major access road of the village. The age of the house is said to be a little younger than Yang-jin Dang. After a couple of extensions and renovations, the present structure was shaped around the seventeenth century. Chung-hyo Dang is similar to its elder brother, Yang-jin Dang, but there are three major differences: First, the main body of the house is facing Southeast, though the Shrine (the Sadang-chae) has same direction as that of Yang-jin Dang. Second, the location of the Sarang-chae is different. The Master’s pavilion is put forward leaving ample yards behind. Third, the gate building, called Munkan-chae is separated from the main body of the building. The high-roof main gate is located not at the center, but to the right side of the gate building. There is a wall between An-chae and Sarang-chae dividing the outer yard and the kitchen yard. To the right side of the house stands a new concrete building recently built as a Memorial for the Prime minister Ryu, who was the second son of the family. The house is also a national treasure.

[Fig. 11, 12, 13, 14]

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8 Chu, Ibid., pp.153-162
Figure 15. Site Plan, Buk-chon Daek

Figure 16. Plan, Buk-chon Daek
3.3.3.
Buk-chon Daek

Since Buk-chon means the north village, Buk-chon Daek (北村宅) is situated at the center of the north village facing East. The house is said to have been built around the middle of the nineteenth century. Therefore, there is a considerable time lapse between Buk-chon Daek and the former two. The house consists of four distinctive parts: Munkan-chae (the gate building), An-chae (the courtyard building), Sarang-chae (the Master’s pavilion), and Sadang-chae (the shrine building). When the Master’s pavilion is separated from the main body of the building, it is sometimes called Byul-chae, which means a separate building. In Buk-chon Daek, the Master’s pavilion is the Byul-chae slightly tilted to inside. We can find the trace of the Master’s quarter still remaining at the front part of the courtyard building, which suggests that the Byul-chae was built later than the courtyard building and the front part was used by the Master before the separate building was built. The house is classified as a historically preserved building.

[Fig. 15, 16]

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9 Kim, Ibid., pp.82-88
10 See the glossary of Korean terms in Appendix 2.
4. Rule Making

4.1. Initial Design Constraints

The first part of the rule making is to define a broad basis of constraints for the traditional houses in Korea. What constraints are generally common in those houses and how do we understand and identify them as critical? First, we will start from the conventional knowledge of the whole shape of the traditional houses, and then, we will look into the essential relations between the elements from which the houses are composed.

4.1.1. Typological Constraints

There are two major aspects characterizing the form of traditional houses in Korea. One is their material and structure, the other is the concept of Poong-su, the Korean term geomancy also called feng-shui (風水) in China.

Structure

Wood is the major material used in traditional architecture. Stones are rarely used in residential architecture except as a base for the wooden column, and bricks, either baked or dried earth, are only for chimneys and exterior walls, not for a
Rule Making

structural part of building. The structural system is a post and beam system.[Fig. 17] The partial ceiling plan of Chung-hyo Dang shows the orthogonal organization of the structure.[Fig. 18] Structural members are all made of wooden columns, beams, rafters and purlins, and the major part of the infill materials are also wood - wooden doors, windows and plastered walls on wooden lath core.¹

Constraint 1 (Structure)

The structural system is wood frame(post and beam) structure.

Basic Shape

Because of its tectonic quality, the wood frame makes an orthogonal structure. The elementary shape of the structure is a square space defined by four columns at each corner, similar to the primitive hut drawn by Abbé Laugier. [Fig. 19] It is called *kan* (한) in Korean. Actually, the term *kan* means something ‘in between’, but when used in architecture, it is a module space signifying a bay - between columns.²

In a Korean folk song, we hear about a model for a minimal house known as a *thatched-roof-three-kan* (*Choga-samkan* in Korean) house. *Thatched-roof* denotes the quality of the house which is very humble, and *three-kan* represents the minimum size of the house, which is composed of three *kan* spaces; maybe one for a kitchen, another for a room with panel-heating floor, the other for a room with wooden floor. The initial shape of the traditional house is the linear connection of *kans*, or what can be called  ∞ shape (linear shape), as we can find in the *three-kan* house. In bigger and more complex houses, variations from  ∞ shape are found; namely L shape (L-shape), U shape (U-shape) and  □ shape (courtyard shape). In a built/unbuilt drawing of Hawhoe village we can easily identify the four shapes of houses. [Fig. 20]

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Constraint 2 (Basic Shape)

There are four basic shapes of houses; *linear shape, L-shape, U-
**Rule Making**

*shape and courtyard shape.* One of these four or more, combined and put together, form a house.

**Grid**

Since the structure is composed of orthogonal framing, the house can be registered on a grid, based on the modular kan space. The grid is used not only for positioning and arranging the elements, but also for figuring out the overall shape of the building. Although there is a difference between the dimensions of kans (from 8 feet to 10 feet), we can generalize the orthogonal framing in a uniform square grid. The module of the grid would be 9' x 9'; however, considering the half-kan space, the 4.5' x 4.5' module can be used as well.
Constraint 3 (Grid)

The dimension of the structural module is ranging from 8' to 10'. Generally, an orthogonal grid of 9' x 9', and a supplementary 4.5' x 4.5' sub-grid can be used.

Poong-su

Poong-su or geomancy is known as a kind of pseudo-science of finding favorable or auspicious places for people, either living or dead. It is based on the belief that there exists hidden currents underneath the ground running along the shape of the terrain. A site for a tomb or a house or a city is good, if it is founded and placed on the exact node of the currents. The ideal shape of the Poong-su site is surrounded by mountain ridges and winding waterways. Physically, there are three main concepts that represent the idea of Poong-su. First is the concept of the center. In every Poong-su site, there is only one Bright Yard on which the main building is supposed to be placed. The Bright Yard is the center of the house as well as the center of a microcosm. In a traditional house, the center is the courtyard or front yard, notwithstanding the location of the yard.

Constraint 4-1 (Poong-su, the Center)

A courtyard or a front yard is the central space of the house, and located according to the site conditions.

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The second concept of the Poong-su is territory. Since its site receives special currents, the site is distinguished from other ordinary places. In a larger site, the demarcation is formed by mountain ridges and waterways. In houses and palaces, it is walls and buildings. There is always a certain concept of territoriality in houses in terms of control and power. Poong-su reinforces the concept of territoriality. Like the ideal site of the Poong-su showing the layers of mountains, a house, when it has more layers of walls and buildings - by increasing the depth of territory, is supposed to be a better house.[Fig. 23]

Constraint 4-2 (Poong-su, the Territory)

A house has a territory explicitly defined by walls and buildings.
Thirdly, the orientation is another concept in the *Poong-su* theory. Thinking that a compass was originally a product for the *Poong-su*, we can imagine the importance of the orientation. Some books show where to locate a compass and how to read.[Fig. 1] However, when it comes to locate the actual direction of the building, the reading differs from person to person. Because the *Poong-su* is based on the interpretation of topological shape and directional meanings, there is no absolute rule for orientation. The most popular concept of orientation is fitting the direction of the major building well to the shape of the natural surroundings, always placing mountains behind and waterways in front.

Constraint 4-3 (*Poong-su*, the Orientation)

The orientation of the main building follows the shape of the site and surroundings, backed by mountains behind and facing roads and waterways in front.

4.1.2. Technical Constraints

Columns and Walls

Wooden columns and beams construct the structural frame of the house. Usually, the section of a column is square. There is no written record of regulating a round column, but, conven-
tionally, a finished round column is said to be prohibited in residential buildings, although there are some exceptions found in large houses remote from Seoul, the central government.

Constraint 5.1 (Columns)

Columns are always located at the center of the intersection of the grid, or the sub-grid.

Constraint 5.2. (Bay)

A bay is the typical distance between two adjacent columns, the 9' main grid.

The interior infill walls are always terminated by columns, except a few ended by other walls. No retaining walls are found inside the house. The materials are either wood or plaster. The infill between two columns can be: 1) a plastered wall, 2) part wall+door(or windows), 3) a full door, or 4) open(no infill). [Fig. 24] The full door infill includes a convertible one, of which doors can be folded and lifted to make two spaces into one. The outside walls for boundaries are thick and free standing walls made of stones and bricks, which are not necessarily orthogonal.

Constraint 6.1 (Infill Walls)

Interior walls are always placed between columns, and some-
times between other infill walls, but never stand free.

Constraint 6.2 (Infill Walls Types)
There are four types of infill: the wall type, the wall+door(or window) type, the full door type and the open type(no-infill).

Floors
The type of floor is distinguished by its material and finish as well as by its use. There are three types of floor:

1. Compact earth or dirt floor with minimal finishing for service use, such as kitchen and gate.

2. Panel-heating floor, a kind of elevated ground called ondol, made of corridors of heat channels covered by stone panels, plastered and finished by oil paper, which is used for the main rooms for living and sleeping.[Fig. 25]

3. Wooden floor, called maru, also suspended from the ground used for Daechung(a big wooden floored living space in Summer) and other service spaces.[Fig. 26]

Roof
The roof framing is post and beam structure. The typical framing systems in traditional buildings are the three-purlin system, five-purlin system and seven-purlin system.[Fig. 27]
Among them the seven-purlin is not popular in residential buildings. Generally, the difference between the three- and five-purlins is that the three system is supported by the module.
span of one bay, and the five-purlin system by the span of more than one bay (from 1.5 bay to 2.5 bay). The five-purlin system, therefore, makes bigger rooms and a higher roof.

Constraint 7 (Roofs)

There are two kinds of roof framing system; the *three-purlin system* covers the width of 1.0-bay span, and the *five-purlin system* covers the width of up to 2.5-bay span.
**Kan Type**

The basic element of the space is a *kan*. As mentioned before, a *kan* is initially a square space defined by four columns at four corners. However, it has changed as a module of space, meaning one bay by one bay. Thus, the *kan* carries the concept of module; the minimum size of a room is a half *kan* space, and a bigger room (*Daechung*) can be over six *kans*. The general size of a room ranges from one to three *kans*. The shape of the space in a *kan* can be divided into three types closely related to the three types of floors: the earth floor, the wooden floor, and the panel floor.[Fig. 28, 29]

**Constraint 8.1 (Kan)**

*Kan* is a square modular space of 1.0-bay x 1.0-bay. The height of *kan* varies from 8' to more than 12' according to the type.

**Figure 28.**

Three Kan Types

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![Diagram of Kan Types](image)

**Earth Floor**  **Flooring**  **Panel Heating**
Rule Making

Figure 29.
Distribution of Kan types in Three Houses
Constraint 8.2 (Kan Module)
The minimum module of space is a half kan, 0.5-bay x 1.0-bay.

Constraint 8.3 (Kan Type)
The types of kan are one of three: the Earth floor kan, the Panel floor kan or the Wooden floor kan.

Constraint 9.1 (The Earth Floor Kan)
Kans used for service space, such as kitchens, gates, storages or stables. Each kan has an earth floor and, at least, one of the four side walls is open(no-infill) to outside.

Constraint 9.2 (The Panel Floor Kan)
Kans for the bedrooms(ondol rooms) only. An ondol room is a cubic space consisting of a panel-heating floor, a false ceiling and four infill walls. The level of the floor is about 1.5' above from the ground.

Constraint 9.3 (The Wooden Floor Kan)
Kans for the major living spaces, Daechung(a big living room) and maru rooms(wooden floored rooms) as well as for the services, such as corridors and storage. Each kan has a wooden floor at the same level as the panel floor rooms, but does not have a false ceiling. Some are enclosed by four infill walls(maru rooms and storage); others have one side open(Daechung and corridors).
Figure 30.
Variations of Kan Types
Relations of Kans

Since the element of the space is a kan, the relations between kans are closely related to the types of infill. The wall infill without any openings means that two spaces are adjoining but not accessible to each other. The door/window infill, part or full, connects two spaces. If there is no infill, two spaces are basically the same. Most of the relations between two kans found in the houses are either the wall type or the no-infill type. The door/window relation is mainly the relation between panel floor rooms, or panel floor room and wooden floor room.[Fig. 30]

Constraint 10.1 (Kan Relations, Panel Floor/Panel Floor)
The relation between two panel floor kans is usually the full door type or the wall type or the open type, or rarely the wall+door(window) type.

Constraint 10.2 (Kan Relations, Panel Floor /Wooden Floor)
The relation between a panel floor kan and a wooden floor kan is generally the wall+door(window) type or the full door type, rarely the wall type and never the open type.

Additional Spaces

There are certain space which are not clearly defined by the concept of the kan. They are the additional space attached to the main body of the building. The major additional space is
Figure 31.
Additional Spaces in Three Houses

Yang-jin Dang

Chung-hyo Dang

Buk-chon Daeik

- Additional Maru
- Additional Room
the wooden floor(*maru*) extension, which is used as a circulation for the rooms. As the single band of wooden floor is added to the main building, the additional floor acts as a transitional space between the inside and outside. Another type of additional space is the closed one. Bounded by small columns and walls, it is attached to the main room to make a bigger room or can be used as a closet.[Fig. 31]

Constraint 11 (Additional Spaces)

Two types of additional spaces are possible. One is an open floor, an extension of *maru*, and the other is a closed space for a closet or an extension of a room.
4.2. Strategical Design Rules

The initial design constraints define the general form of the traditional houses. However, based on the initial design constraints, diverse forms of houses are possible. Then, what makes the form of the three Hawhoe houses? When we play a board game like Chess or Go, we deliberately choose a few strategical ways to deploy the game pieces. Especially for the learners of the game Go, there are numerous examples of 'standard play'. It is a set of play which possibly results in a best resolution for a certain situation during the play. These standard deployments are learned by most players as 'rules of thumb', which are implicit rules, but which allow players to cope with an overall strategy. Therefore, when they come across the same or similar situation, both players know how to deal with the situation without thinking much of the details. Similarly, in designing, the rules are partly derived from heuristics and partly from the conventional knowleges for specific resolutions. We can clarify more specific knowledge and rules, meaning the strategical design rules, which distinguish the design of Hawhoe houses from that of other houses.
4.2.1. Typological Rules

One of the underlying thoughts that constitutes custom and ways of living in Korea was Confucianism. People were supposed to behave according to the ethic of Confucianism. Since Hawhoe village is located near Andong city - the center of Korean Confucianism, where many Confucian schools were located, there have been a strong influence. A family was the core of social relationship which was seen as a microcosm of the world and nation. Men and women were different in their roles of a family and of a society. Therefore, there had been the separation of living area. Youngers should respect elders, and memories on ancestors were kept and told through generations. Thus, a shrine was built and maintained in the house. All these are represented in the typology of the Korean traditional houses.

Building Type Elements

As mentioned in the description of the houses, each house is composed of four parts. The idea was directly influenced by Confucianism. There had been a differentiation between the domain of men and that of women, which divided the Master's quarter and Mistress' quarter. A shrine was introduced to respect and worship ancestors of the family in a house.

1. Courtyard building or An-chae in Korean, a basic unit of

\[ \text{See Chapter 3 for description} \]
the house, the family and Mistress’ quarter.

2. Master’s pavilion or Sarang-chae in Korean, the Master’s quarter

3. Gate building or Munkan-chae in Korean, a forefront building with the main gate.

4. Shrine or Sadang-chae in Korean, a shrine for ancestors, a ceremonial building and surrounding space.

Among these four buildings, the An-chae is a courtyard shape building[Fig. 32] and the others are linear shape buildings. What makes the difference between the linear shape buildings is their width. The Master’s pavilion and the Shrine are two-bay structures, whereas the Gate building is a one-bay structure.[Fig. 34] The Shrine is only a six-kan building(3 kans \times 2 kans) with small spans,[Fig. 35] while the Master’s pavilion is more than ten kans large with much wider spans.[Fig. 33] In the three houses, the length of the Master’s pavilion ranges from five bays to seven bays. The Shrine is separately enclosed by walls and there is a gate in the middle of the front wall which can be open only at a time of ceremony. One side of the Courtyard building is two-bay, or two and a half in Buk-chon Daek, width, which makes the main body of the building where the main rooms and a Daechung, a big floor, are located. The other three sides are one-bay structure, except the front one in Buk-chon Daek which is one and a half.[Fig. 32]
Rule 1 (Building Types)
A house is composed of four building types; the Courtyard building, the Master’s pavilion, the Gate building and the Shrine.

Rule 2.1 (The Courtyard Building)
The building is a courtyard shape. The main body of the Courtyard building is 2.0-bay or 2.5-bay width and the other three sides are generally 1.0-bay width.

Rule 2.2 (The Master’s Pavilion)
The Master’s pavilion is a linear shape. The width of the building is 2.0-bay and the length is 5.0-bay or more.

Rule 2.3 (The Gate Building)
The Gate building is a linear shape. The building is 1.0-bay in width.

Rule 2.4 (The Shrine)
The Shrine is a linear shape 3kan X 2kan building surrounded by four walls.

Orientation of the House
The three houses show that the major orientation of the house differs according to the site location and the accessibility. It is also difficult to tell where is the main mountain for the house.
in a geomantic sense. Generally, the house is facing a road or the river in front reserving some area behind the house as a imaginary small mountain. In the house, the orientation of the Courtyard building and the Gate building is the same, but the others may have different orientation.[Fig. 36]

Rule 3 (Orientation of the House)
The Courtyard building and the Gate building have the same orientation.

Building relations
The Master’s pavilion and the Gate building can be attached or detached to the Courtyard building, while the Shrine is always a separate building. Three types of relations between the Courtyard building and the Master’s pavilion are found in the Hawhoe houses. First, in Yang-jin Dang, the two buildings are joined by a kan and a half connector. As the structure is continued one from another, both buildings are registered on the same orthogonal grid.[Fig. 37] In Chun-hyo Dang, one overlaps another. They share two-kan space and the same structural framing.[Fig. 38] But, in Buk-chon Daek, two buildings are separated and have even different orientations. The Master’s pavilion is vertical to the Courtyard building and slightly tilted about 10 degrees towards the inside to face the main gate.[Fig. 39]
Design Rule Making: A Study of Hawhoe Houses in Korea

Rule 4 (Building Relations)
Any two buildings in a house, except the Shrine which is always detached, can be joined or overlapped or separated.

Rule 5.1 (Joined)
When two buildings are joined together, there is a joint space in between the two buildings which is neither a part of one nor the other.

Rule 5.2 (Overlapped)
When two buildings are overlapped, they share the structure and one uses part of the space of another.

Rule 5.3 (Separated)
When two buildings are separated, they do not have to use the same grid. However, one is related to another in a certain arrangement, such as by the location of the wall in between them.

Yard Types
In traditional houses, open space is as important as the space inside. The open space of the house is explicitly divided into several yards by walls and buildings, and each yard is related to the others in a specific pattern. Although it is said that a well-fitted high-class residence should be equipped with seven yards and eight gates, we can find five distinctive yards in the three houses. A simplified drawing of Yan-jin Dang
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shows five divisions of the yards: outer yard, courtyard, kitchen yard, back yard and side yard (or shrine yard). [Fig. 40]
Similar divisions are found in Chung-hyo Dang and Buk-chon Daek. [Fig. 41, 42] Whereas, in Chung-hyo Dang, the division between the outer yard and the side yard is not clear, we see how careful landscaping defines the outer yard: a couple of trees suggests an entrance to the side yard.

Rule 6.1 (Yard Types)
A house has five yards: outer yard, courtyard, kitchen yard, back yard and side yard.

Rule 6.2 (Yard Walls)
Each yard is defined by walls or buildings. The dividing wall is always connected to the building orthogonally at the location of a column, i.e. following the grid line, except the boundary wall surrounding the site.

Rule 6.3 (Yard Connection)
A yard is connected to the other by a gate, or a similar threshold.

Although there is a comparable difference in the shape and the location of the yards, we can generalized the organization of the five yards in the three houses. The courtyard is always located in the middle and the other yards are arranged around the courtyard. [Fig. 43]
Rule 7.1 (The CourtYard)
The courtyard is the center of the house. However, it is not located at the center of the site, but to the left and front side according to the site condition and the location of other yards. The courtyard can be connected to any yards except the back yard.

Rule 7.2 (The Outer Yard)
The outer yard is the yard between the courtyard and the main gate. It is the front yard of the Master's pavilion and, therefore, a semi-private space where common visitors are allowed to come in.

Rule 7.3 (The Kitchen Yard)
The kitchen yard is a service space connected to the kitchen in the Courtyard building. The yard can be approached from the outer yard or directly from the outside through a small gate.
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Rule 7.4 (The Back Yard)
The back yard is originally made as a garden representing a foot of mountain at the back of the house and later it is used as a ground for growing vegetables. For its maintenance, the yard is connected to the kitchen yard through a gate.

Rule 7.5 (The Side Yard)
The side yard is located to the opposite direction of the kitchen yard. Sometimes it is called 'shrine yard' because the Shrine is placed in the one side of the yard. The side yard is connected to the outer yard.

4.2.2. Technical Rules

The Courtyard Building
The Courtyard building is a prototypical shape of the house from which the other building types are generated. The Master's pavilion is derived from the main body of the Courtyard building and the Shrine is transformed from the Daechung space. The Gate building is also a replica of a wing of the Courtyard building. In a small house, these four buildings are condensed into a courtyard house.

The main body of the Courtyard building is composed of three elements: a kitchen, main ondol rooms and a Daechung. The
kitchen is always at the left end of the main body, occupying more than three-kan space, including one or two from the wing of the building. The main ondol rooms for the Mistress are located next to the kitchen. They are panel-heated from the stoves in the kitchen. Two adjoining ondol rooms are placed to the right of the kitchen. The depth of the room is decided by the span of the main body. If it is a two-bay span, the depth is one and a half; if it is a two and a half-bay span, the depth is two, because they leave a half-bay circulation space in front.

Next to the main room is the Daechung, a large wooden floor(maru) - a major living space especially in Summer. The Daechung has a two-bay width and a two-bay or two and a half-bay depth, which makes four or five kans, one of the biggest spaces in the house. There is another ondol room and a circulation space at the other end of the main body of the Courtyard building. The size and the shape of the room is similar to the main room across the Daechung. Therefore, the main body of the building has the typical connection of kitchen + ondol room + maru room (Daechung) + ondol room. [Fig. 44]

The other side of the Courtyard building is a single kan space. The left side of the building is a storage space of two kans or more, and the two front corners are the complex of ondol rooms and maru rooms. In here, also, a similar pattern of ondol room + maru room + ondol room is found. [Fig. 45] Every

Figure 44. The Relations of Rooms in the Main Part of the Courtyard Building

Figure 45. The Relations of Ondol Rooms and Maru Rooms

Figure 46. The Location of the Gate in the Courtyard Building
ondol room is adjoining a maru room, except for those in the Gate building where the room is less significant. Each side, other than the main body has a gate to connect the courtyard to other yards.[Fig. 46]

Rule 8.1 (The Courtyard Building, The Main Body)
The main body of the Courtyard Building is composed in a connection of ‘a kitchen + two main ondol rooms + a Daechung + another ondol room’. There is also a circulation space, at least a half-bay depth, in front of the each room.

Rule 8.2 (The Courtyard Building, Ondol Rooms)
The other side of the Courtyard building is consist of Ondol rooms, maru rooms, storages and gates. There, an ondol room and a maru room are always adjoined together. Two adjacent ondol rooms are not impossible, but they are provided with adequate additional maru spaces.

Rule 8.3 (The Courtyard Building, The Gate)
A gate is located in each side of the Courtyard building except the main body; one is in the kitchen, and another is usually a two-kan gate on the right side, and the other is a middle gate - a formal gate to the courtyard.

The Master’s Pavilion
The pavilion is similar to the main body of the Courtyard building. It has main rooms for the Master to the left and a
Daechung to the right. In Chung-hyo Dang, there is another *ondol* room and *maru* room to the right end. Since Buk-chon Daek has a separate pavilion, it has a two-kan service space for heating to the left end, and also two *maru* rooms to the right end. The Daechung of Yang-jin Dang is the largest room of six *kans*, while other Daechungs are three and four *kans*.

**Rule 9 (The Master's Pavilion)**

The major feature of the Master’s pavilion is the main room complex and a *Daechung*. The organization of them is similar to the main body of the Courtyard building without a kitchen.

**The Gate Building**

The Gate building is an open ended linear building. The main gate can be located at any *kan* except the end. Generally, the main gate is located to the right of the middle gate in the Courtyard building. [Fig. 47] The other part of the Gate building is
Rule Making

composed of storages, stables and a few ondol rooms for servants or temporary use.

Rule 10.1 (The Gate Building)
The Gate building is located in the forefront of the site. The building has the main gate and other service rooms.

Rule 10.2 (The Gate Building, The Main Gate)
The main gate is one kan, placed to the right of the middle gate in the Courtyard building, but not at the end kan of the Gate building.

The Shrine
The Shrine is a separate building, always surrounded by walls. It has a sacred space, a room of six kans, where plaques of ancestors are kept. The size of the kan is relatively smaller than the other building, such as 6 feet by 6 feet.[Fig. 48] There are two shrines in Yang-jin Dang, which is not common in an ordinary house. Usually, there is one shrine, as in Chung-hyo Dang and Buk-chon Daek.

Rule 11 (The Shrine)
The Shrine is located to the right and behind the Courtyard building. The Shrine has only a small six-kan room with a door in the middle.
5. Simulation

The purpose of the simulating the design rules falls into two parts. First, it can be used as a ground for testing the design rules made in the previous chapter. Whether the rules written are relevant and sufficient enough to be used as a set of design rules for the Hawhoe houses will be examined, and if not, we may find what is needed or unnecessary. The second purpose of the simulation is to understand more about the role of rules in designing. It is related to the more profound question of whether rules are playable, and if so, how people understand these rules and how they interact according to specific rules.

5.1. Following Rules

The fundamental fact here is that we lay down rules, a technique, for a game, and that then when we follow the rules, things do not turn out as we had assumed. That we are therefore as it were entangled in our own rules. This entanglement in our rules is what we want to understand.1

The power of simulation is in its commitment. If rule making is a process of abstraction from the existing design world, simulation is a process of materialization towards the design world. In simulation, thus, the process is exactly the inverse; however, the product is not necessarily a return to the starting point. Rather, it suggests a new domain of the design world.

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1 Wittgenstein, Ibid., §125, p.50
Therefore, the simulation we are dealing here is different from those designed only to imitate real situations, not just because designing is a kind of simulating process, but there are people, the players whose own minds are involved in the simulation.

Following rules is another way of reading. If making rules is to writing, following them is to speaking. In each case, reading is crucial; whereas, for the former, it is reading from the artifacts, for the latter, it is reading of rules that derives an activity to express a certain form, an artifact. However, as Wittgenstein puts it, things usually do not turn out as we had assumed. For Wittgenstein, rule-following is one of the major parts of his investigations in philosophy of language, especially when he introduces the term ‘language game’.

Similarly, in designing, we cannot assume what turns out to be by simply following the design rules. At first, it depends upon how the rules were written, their explicitness and congruency. But still, like at any level of design, it also involves difficulties in communication and personal interpretation, because design is a kind of social behavior. Provided that here are a written set of rules and supplementary graphics, and considering that these are the design rules, there is only one way to determine if players act according to the rules or not - by agreement between players and between the rule maker and players. Therefore, through the activity of simulation, we can learn about the process of design as well.

\[^2\text{Ibid. §7 reads, “I shall also called the whole, consisting of language and the actions into which it is woven, the ‘language game’.”}
\text{Also, in §23, Wittgenstein describes that “the term ‘language game’ is meant to bring into prominence the fact that the \textit{speaking} of language is part of an activity or a form of life”, which is followed by an extensive list of language game.}\]
5.2. The Game

The simulation of the design rules is a kind of game which is not competitive. A player can play either by oneself or with others, but there is no way to compare the outputs of the playing. It can be considered more or less as a design project.

5.2.1. Technical Universe

In simulation, we grant that we are not dealing with reality. However, without a certain analogy to the real world, it is easy for simulation to lose its power, a power of similitude. In designing, simulating rules inevitably concerns formal representation. A practical question in simulation is, therefore, what can be used as a medium of abstraction and what are the tools for playing. In the profession of architecture, the mediums of abstraction are two dimensional, such as sketches and drawings, or three dimensional, such as perspectives and models. These provide architects with a gamut of freedom in expression, the universe that they have learned to work with. Simulation of design rules may follow the same tools, or may define another set of tools in a different universe. It can be called a 'technical universe'. According to Habraken, who introduced the word in his *Concept Design Games*, the technical universe of a game consists of the pieces used in the game and the relations allowed among them. The same

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3 Habraken et. al., *Concept Design Games*, 1987, 3-2
technical universe can be used in different games, because it can be regarded as an abstract form without any meaning attached. But, in playing with them, players are usually biased by the shape of the technical universe. Therefore, the technical universe not only concerns the selection and distribution of game pieces, but also suggests the level of abstraction and analogy to reality.

In this simulation two kinds of technical universe are used. One is more or less a conventional one: a pencil on paper. Players are supposed to make a sketch of plan-like abstract drawing in which a number of pieces of information are combined. The other is a set of small wooden blocks, made for the convenience of the play, representing the basic module of space types, *kan.* [Fig. 49] Three colors of wooden blocks are provided to help players design a scheme for the abstract drawing.

5.2.2. The Site: Nam-chon Daek

In the previous chapter, we assumed a set of design rules derived from a group of Hawhoe houses. Now, based on these rules, we will see if we can design a family of Hawhoe houses.

The site of the simulation is located in the same village, Hawhoe. As briefly mentioned in the Chapter 3, there is another house, called Nam-chon Daek, of which the main
Figure 50.
Site Plan, Nam-chon Daek

buildings were burned down leaving only a gate building and a shrine. [Fig. 50] The house is situated in the southeastern part of the village, facing the road running southwest to northeast. The area of the house is smaller than that of the other three houses though, there is enough space for a courtyard building and a Master’s pavilion. There are several trees in the site which are left at a player’s disposal.

The site is provided for the player as a plan with existing buildings, with walls and trees on it. For the purpose of manipulating the wooden pieces, the scale of the site is fixed to a half inch to the main grid spacing - 9 feet (i.e. 1/2" = 9")
5.2.3. Playing Rules

The goal of the simulation is to reconstruct a new Hawhoe house, Nam-chon Daek, based on the design rules. Among the four buildings of the house, a courtyard building and a Master's pavilion are supposed to be designed by the player, though the other two existing buildings may also be changed if the player intend to do so. All the other conditions are open to the interpretation of the player except those of the design rules. In a case where the player has difficulty in reading the rules, he should consult the rule maker.

Since we are using two kinds of technical universe, the simulation is composed of two phases. At the first phase, a player is provided with a set of game pieces, wooden blocks, and a rule book, a summary of the rules made in the previous chapter. A player is asked to work with the wooden blocks on the site plan of Nam-chon Daek, in order to figure out the whole shape of the house, based on the reading of the design rules. Other information about the Hawhoe houses may be provided if needed for play.

There are two kinds and three colors of wooden blocks. A cube stands for a kan space and a half cube a half kan space, a minimum module of the house. Each piece is colored in red, or yellow, or green, representing an earth floor kan, or a panel floor kan, or a wooden floor kan, respectively. By arranging
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Three space types of kan pieces, a scheme of a house is composed. For the player to get used to the pieces, one of the Hawhoeo houses can be presented by using the same pieces. The second phase is a kind of design development. According to the drawing dictated from the form of house made by wooden pieces in the first phase, the player is supposed to elaborate his or her design of the house. In this phase, therefore, the player has to define each room, its shape and relations to the other rooms, and the yard division of the house.

In the thesis, four players are selected based on diverse disciplines and backgrounds, and their simulations are listed here. [Fig. 51, 52, 53, 54] Three players have an architectural background and one does not. One of them is a Korean who is familiar to the architecture and the others are an Indian and two Americans who have barely seen Korean traditional architecture.

The simulation may be continued to the degree of detail, but considering the effect of design rules, it is better to finish the simulation at a level of abstraction that allows us to get a good glimpse of the whole house. The final products are recorded and represented in a same manner so that we can compare them with the existing three houses. (See Figure 29 for reference) Figure 55 and 56 are examples of more detailed plan, developed from the simulation I and II, respectively.
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Figure 53. Simulation III

Figure 54. Simulation IV

Panel Floor Kan
Wooden Floor Kan
Earth Floor Kan

NAM-CHON DAEK
Simulation

Figure 55.
Plan developed from Simulation I

Figure 56.
Plan developed from Simulation II
5.3. Review and Reflection

The results show that each simulation has certain characteristics of Hawhoe houses that can be represented as Nam-chon Daek. Moreover, the process reveals the characteristics of the design rules as well. By observing the simulation, two matters become clear: one, the fact that the reading and the acting are not always consistent; and the other, that the simulation is another agreement game in itself.

There might be a number of reasons for the inconsistency, but what came to surface is the role of the technical universe. In the simulation, the major technical universe was a set of wooden blocks, which was given to players without any specified game rules for the technical universe itself other than the design rules for Hawhoe houses. The players, thus, confronted two phases of the design rules in this game; at first, each one had to internalize the design rules, and, then, render them in terms of the technical universe. Therefore, it was the player who should make a bridge between them. In the simulation, some players were more logical in connecting them, and others acted more or less ad-hoc. Everyone involved in the simulation experienced some difficulties. The difficulties of the technical universe is that the design rules are not made exactly for the technical universe, but for the design. The design rules, in this thesis, do not define the shape and
function of the technical universe. When a player begins to play with the technical universe, he or she has to deal with the abstraction the tool offers. How the technical universe does cope with various aspects of the design rules, then, becomes a key question. We may use a different technical universe for the simulation of the same rules, and the same technical universe for the different rules, or games. However, the technical universe should be the one that gives a more concrete idea of how design rules interact, and that provides a clue to the next move, not because it is guided by the rules, but because the form is formulated by the shape through the technical universe. In order to deal with the design rules effectively, the technical universe has to be simple and easy to manipulate and open to transformation towards more complex forms.

The simulation process, also, reassures that the rules are viable only through mutual agreement. Although, players read through the rules and referred to them while they were playing, they used to skip some rules by chance or intentionally. Even if the rule maker was always there to clarify each question concerning the rules, the players set their own version of the rules. As a rule maker, I could not help but be involved in the simulation, for the players and the rule maker have to reach some agreement on the design rules in order to continue to play. At some points, when explained, the play-
ers agreed and understood the rules. However, in some cases, after having found a conflict between the rules and the move the player made, (s)he still insisted and justified the move based on his or her own judgement, not listed among the rules, such as that the trees on the site should be preserved or that the house must have some toilets. The conflict was resolved by reaching an agreement, a kind of negotiation between the player and the rule maker. Therefore, in fact, every player have played with a slightly different version of the design rules, based on his or her reading and the agreement.

These observation lead us to some suggestions about the design rules. First of all, more study is needed about how people interact with the rules. Making and playing a game is probably one of the best answers to explore this. Secondly, more systematic researches on the technical universe are possible in relation to the design rules, because the technical universe is not just a signifier but more of a sign. And finally, we can proceed to a more ambitious step towards new design rules. According to a contemporary paradigm, we may put forward a new version of the design rules by transforming the old ones.
6. Conclusion

It is difficult to conclude. It seems that we are standing on the starting point again. The difference is that we are equipped with some knowledge and tools to explore a piece of the design world.

If we make some clarifications about what we have found hitherto, it would be as follows:
1. In every artifact, if we think there is a kind of system inside, we can express the system in terms of the design rules.
2. The design rules, thus, made neither a universal nor a positive theory, but a personal reading.
3. However, some rules are more widely accepted by the people involved in design and these seem to represent basic characteristics of the artifacts. These rules can be called critical.
4. A set of the critical design rules for the Hawhoe houses in Korea can be suggested by means of abstraction of the existing houses.
5. The design rules for the same houses have been applied and the result shows that everyone, notwithstanding their backgrounds, can design a Hawhoe house with a set of the design rules.
6. The simulation is important, not only in that it shows whether the rules are critical or not, but also that there is a commitment, an activity of design by the people, which is
overlooked by many descriptive theories.

7. The simulation, put in the form of a game, introduces the technical universe, the tool for abstraction in playing a design game.

8. Throughout the play of the game, people continuously re-interpret the design rules in terms of their own frame of reference.

9. The process of making rules and playing with them reveals the possibilities of new design rules and a new perception of design, that, otherwise, would be impossible only by pursuing the design itself.

It is not clear whether the study of the design rules can be used to arrive at a new design. However, it becomes evident that the study is a way to understand the conventions behind a architecture and its design. In practice, architects approach design tasks by way of abstraction. The logic an architect has can be represented either explicitly and consistently, or implicitly and inconsistently, but always based on conventions of the time and place. Rules, probably another way of abstraction, can make us understand conventions better and even lead to new conventions. This would be the conclusion or perhaps a new beginning. To illustrate this, I think it is worthwhile to quote Colquhoun, who shows how Le Corbusier began his argument on modern architecture in terms of his own rules; the ‘Five Points’.
... he (Le Corbusier) took as his starting point the rule system of the academic tradition. This is demonstrated by the rules which Le Corbusier prescribed in his “Five Points,” each of which takes its departure from an existing practice and proceeds to reverse it. The use of *pilotis*, for example, is a reversal of the classical podium .... The *fenêtre en longueur* is a contradiction of the classical window aedicule. The roof terrace contradicts the pitched roof and replaces the attic story with an open-air room. The free facade replaces the regular arrangement of window openings .... The free plan ... replaces it (the need for structural walls) with a free arrangement of nonstructural partitions determined by functional convenience.1

1 Colquhoun, ‘Displacement of Concepts in Le Corbusier’, Ibid., p. 51
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26, 28, 37B, 57, Photo from Y. Kim, *Hawhoe Village of Andong*. Other photographs by author.

Numbers are pages.
Appendixes

1. Hawhoe House Design Rule Book

2. Glossary of Korean Architectural Terms
Appendix 1  Hawhoe House Design Rule Book

Typological Constraints and Rules

Constraint 1 (Structure)
The structural system is wood frame (post and beam) structure.

Constraint 2 (Basic Shape)
There are four basic shapes of houses; linear shape, L-shape, U-shape and courtyard shape. One of these four or more, combined and put together, form a house.

Constraint 3 (Grid)
The dimension of the structural module is ranging from 8' to 10'. Generally, an orthogonal grid of 9' X 9', and a supplementary 4.5' X 4.5' sub-grid can be used.

Rule 1 (Building Types)
A house is composed of four building types; the Courtyard building, the Master's pavilion, the Gate building and the Shrine.

Rule 2.1 (The Courtyard Building)
The building is a courtyard shape. The main body of the Courtyard building is 2.0-bay or 2.5-bay width and the other three sides are generally 1.0-bay width.
Rule 2.2 (The Master's Pavilion)
The Master's pavilion is a linear shape. The width of the building is 2.0-bay and the length is 5.0-bay or more.

Rule 2.3 (The Gate Building)
The Gate building is a linear shape. The building is 1.0-bay in width.

Rule 2.4 (The Shrine)
The Shrine is a linear shape 3-bay X 2 -bay building surrounded by four walls.

Rule 4 (Building Relations)
Any two buildings in a house, except the Shrine which is always detached, can be joined or overlapped or separated.

Rule 5.1 (Joined)
When two buildings are joined together, there is a joint space in between the two buildings which is neither a part of one nor the other.

Rule 5.2 (Overlapped)
When two buildings are overlapped, they share the structure and one uses part of the space of another.

Rule 5.3 (Separated)
When two buildings are separated, they do not have to use the same grid. However, one is related to another in a certain arrangement, such as by the location of the wall in between them.
Constraint 4-1 (Poong-su, the Center)
A courtyard or a front yard is the central space of the house, and located according to the site conditions.

Constraint 4-2 (Poong-su, the Territory)
A house has a territory explicitly defined by walls and buildings.

Constraint 4-3 (Poong-su, the Orientation)
The orientation of the main building follows the shape of the site and surroundings, backed by mountains behind and facing roads and waterways in front.

Rule 3 (Orientation of the House)
The Courtyard building and the Gate building have the same orientation.

Rule 6.1 (Yard Types)
A house has five yards: outer yard, courtyard, kitchen yard, back yard and side yard.

Rule 6.2 (Yard Walls)
Each yard is defined by walls or buildings. The dividing wall is always connected to the building orthogonally at the location of a column, i.e. following the grid line, except the boundary wall surrounding the site.

Rule 6.3 (Yard Connection)
A yard is connected to the other by a gate, or a similar threshold.
Rule 7.1 (The Courtyard)
The courtyard is the center of the house. However, it is not located at the center of the site, but to the left and front side according to the site condition and the location of other yards. The courtyard can be connected to any yards except the back yard.

Rule 7.2 (The Outer Yard)
The outer yard is the yard between the courtyard and the main gate. It is the front yard of the Master's pavilion and, therefore, a semi-private space where common visitors are allowed to come in.

Rule 7.3 (The Kitchen Yard)
The kitchen yard is a service space connected to the kitchen in the Courtyard building. The yard can be approached from the outer yard or directly from the outside through a small gate.

Rule 7.4 (The Back Yard)
The back yard is originally made as a garden representing a foot of mountain at the back of the house and later it is used as a ground for growing vegetables. For its maintenance, the yard is connected to the kitchen yard through a gate.

Rule 7.5 (The Side Yard)
The side yard is located to the opposite direction of the kitchen yard. Sometimes it is called 'shrine yard' because the Shrine is placed in the one side of the yard. The side yard is connected to the outer yard.
Technical Constraints and Rules

Constraint 5.1 (Columns)
Columns are always located at the center of the intersection of the grid, or the sub-grid.

Constraint 5.2 (Bay)
A bay is the typical distance between two adjacent columns, the 9' main grid.

Constraint 6.1 (Infill Walls)
Interior walls are always placed between columns, and sometimes between other infill walls, but never stand free.

Constraint 6.2 (Infill Walls Types)
There are four types of infill: a wall type, a wall + door (or window) type, a full door type and an open type (no-infill).

Constraint 7 (Roofs)
There are two kinds of roof framing system; the three-purlin system covers the width of 1.0-bay span, and the five-purlin system covers the width of up to 2.5-bay span.

Constraint 8.1 (Kan)
Kan is a square modular space of 1.0-bay X 1.0-bay. The height of kan varies from 8' to more than 12' according to the type.
Constraint 8.2 (Kan Module)
The minimum module of space is a half \textit{kan}, 0.5-bay \times 1.0-bay.

Constraint 8.3 (Kan Type)
The types of \textit{kan} are one of three: the Earth floor \textit{kan}, the Panel floor \textit{kan} or the Wooden floor \textit{kan}.

Constraint 9.1 (The Earth Floor \textit{Kan})
\textit{Kans} used for service space, such as kitchens, gates, storages or stables. Each \textit{kan} has an earth floor and, at least, one of the four side walls is open (no-infill) to outside.

Constraint 9.2 (The Panel Floor \textit{Kan})
\textit{Kans} for the bedrooms (\textit{ondo} rooms) only. An \textit{ondo} room is a cubic space consisting of a panel-heating floor, a false ceiling and four infill walls. The level of the floor is about 1.5' above from the ground.

Constraint 9.3 (The Wooden Floor \textit{Kan})
\textit{Kans} for the major living spaces, \textit{Daechung} (a big living room) and \textit{maru} rooms (wooden floored rooms) as well as for the services, such as corridors and storage. Each \textit{kan} has a wooden floor at the same level as the panel floor rooms, but does not have a false ceiling. Some are enclosed by four infill walls (\textit{maru} rooms and storage); others have one side open (\textit{Daechung} and corridors).
Constraint 10.1 (Kan Relations, Panel Floor / Panel Floor)
The relation between two panel floor kans is usually the full door type or the wall type or the open type, or rarely the wall+door(window) type.

Constraint 10.2 (Kan Relations, Panel Floor / Wooden Floor)
The relation between a panel floor kan and a wooden floor kan is generally the wall + door (window) type or the full door type, rarely the wall type and never the open type.

Constraint 11 (Additional Spaces)
Two types of additional spaces are possible. One is an open floor, an extension of maru, and the other is a closed space for a closet or an extension of a room.

Rule 8.1 (The Courtyard Building, The Main Body)
The main body of the Courtyard Building is composed in a connection of 'a kitchen - two main ondol rooms - a Daechung - another ondol room'. There is also a circulation space, at least a half-bay depth, in front of the each room.

Rule 8.2 (The Courtyard Building, Ondol Rooms)
The other side of the Courtyard building is consist of ondol rooms, maru rooms, storages and gates. There, an ondol room and a maru room are always adjoined together. Two adjacent ondol rooms are
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not impossible, but they are provided with adequate additional maru spaces.

Rule 8.3 (The Courtyard Building, The Gate)
A gate is located in each side of the Courtyard building except the main body; one is in the kitchen, and another is usually a two-kan gate on the right side, and the other is a middle gate - a formal gate to the courtyard.

Rule 9 (The Master's Pavilion)
The major feature of the Master's pavilion is the main room complex and a Daechung. The organization of them is similar to the main body of the Courtyard building without a kitchen.

Rule 10.1 (The Gate Building)
The Gate building is located in the forefront of the site. The building has the main gate and other service rooms.

Rule 10.2 (The Gate Building, The Main Gate)
The main gate is one kan, placed to the right of the middle gate in the Courtyard building, but not at the end kan of the Gate building.

Rule 11 (The Shrine)
The Shrine is located to the right and behind the Courtyard building. The Shrine has only a small six-kan room with a door in the middle.
Appendix 2  Glossary of Korean Terms in Architecture

About Residential Architecture

An-chae : The main part of a house, where the family and Mistress live. An means inside or women, and chae means a building. Usually, it is a separate building, such as in the cases of the Hawhoe houses. In a small house, however, An-chae denotes a part of the house where a kitchen, a Daechung, and the main ondol room, which is called An-bang, is located.

Sarang-chae : A part of a house where the Master spends most of the time. In a small house, Sarang-chae is squeezed into a front part of An-chae, and makes a combination of an ondol room and a maru room, a trace of which we can find in the front part of An-chae in Buk-chon Daek.

Munkan-chae : The gate building where the main gate is located. Munkan means a kan space for a gate. It is a forefront building of a house. An ondol room located in Munkan-chae is called Munkan-bang. When the building is combined with a servant's quarter, it is called Haengrang-chae.

Sadang-chae : Sadang is a shrine where plaques of ancestors are kept. According to Confucianism, the building can be open, only during the ceremony.

Byul-chae : Byul-chae means a separate building, but usually named for a separated

Sarang-chae.

Kan : Kan means something in between. In architecture, it is a space between four columns. It is generally used as a modular cubic space of typical one bay span, which varies, according to the type of building and material, from 8 feet to 10 feet.

Ondol : Ondol is a system of heating peculiar in Korean Architecture. Literally, it means 'heated stone'. Ondol system is composed of heat channels made of stone under the floor covered also by slabs of stone. The floor is finished flat by plastering and by oil papers. Heat comes from the furnace attached to the outside of the ondol room, runs through the channels and then the chimney. Inside the room, the full floor gets warm and maintains for several hours, since the stone keeps the heat.

Ondol Room : The room with the ondol floor is the ondol room. It is the room mainly for sleeping and for living in cold weather as well.

Maru : Maru means the wooden flooring and also represents the space with the wooden flooring. It is not the name for special room.
Maru Room : Maru room is the room for living and sleeping and not for storage. It is different from the ondol room only in that it has wooden floor.

Daechung : Daechung is a kind of maru room, which is the largest maru room of the house usually located next to the main ondol room. It is the major living space of the house, especially in Summer.

Tue : Tue means something added or set back, generally used in wooden floor space. Tue-maru is the additional maru space attached to the building, and Tue-kan is a series of wooden floor kan space in front of the building.

About Geomancy

Poong-su : Poong-su is a Korean geomancy, which is called Feng-shui in China. Literally, it means wind and water, a primitive condition of shelter that can be kept from severe weather and accessible to water. Later, Poong-su becomes a mixture of scientific knowledge and fortune telling.

Gook : Gook is a field surrounded by four mountains. It defines the area of territory, where Ki (force or spirit: ch'i in Chinese) of the site is connected to major current of subterranean Ki.

Hyul : Hyul means a geomantic cave or a hole, where a grave or a house is located.

Myung-dang : It is a Bright Yard, a yard in front of a Hyul. Sometimes, Bright Yard includes the Hyul. Usually it means the best place to locate buildings in the Gook of Poong-su.

See Figure 22 for reference.