Embedded Schema:
Towards a New Research Program of Traditional Chinese House Types

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Abstract
Typological study is deeply rooted in the view of seeing house types as a kind of spatial species that have grown out of the soil of building traditions within a given culture. There exist two major methodological challenges: how to construe a type and how to construe the evolution among family types? As opposed to previous studies on typological structures based on rule systems, this paper introduces a new research program directed towards typological evolution issues based on the idea of schema, and the embedded plan for layout arrangement, which may carry an important evolutionary message in its genesis program. Traditional Chinese house types in southeast China and Taiwan are chosen for this undertaking. Seven basic schemas are proposed and verified by their power to describe all cases under study. The paper is concluded with a few remarks on the methodological traits and follow-ups.

Keywords: Chinese house type; typological analysis; schema system; arrangement move

1. From Rule to Schema
Based on the view of seeing house types as a kind of spatial species that evolved from a long course of socio-cultural developments, this paper explores formal relations among various Chinese house types by proposing a few key ideas that can account for the genesis of different types and their genealogical ties, if existent, so as to reveal the driving forces of typological evolution that are otherwise hidden under the historic surface. The central ideas adopted in this study, known as "embedded schema", distinguish themselves from the previous methodology that dwells on the formalism of the production rule system (Wang, 1991) as characterized by its generative power and explicit procedure. Although the rule systems as such are still valid in substance and also very effective as analytical tools, they nevertheless exhibit a major weakness, i.e. the rule system, albeit its powerful performance in producing house variations, cannot carry the information pertaining to the understanding of relations among different types (Wang, 2004), which is central to the questions of typological evolution.

If the traditional built landscape is an article, house types are the words by which the article is written and read. Over a thousand years since the Tang dynasty, the Han ethnic people have continued such a built form, written along their migrations from central China towards the southeast region of Zhejiang, Fujian and Guangdong, which can now qualify as the treasure house of the Chinese traditional house types in terms of the quantity, variety and diversity of the typological words and sentences left and preserved. Reading these rich texts demands new perspectives in order to relate one message to another, in particular, those in China and those in Taiwan.

Based on the data collected from this region over the last decade, this study proposes a new research program which places more emphasis on the issue of inter-relations among diversified family types than on the intra-relations within a particular family type as have been studied before by the production rule system (Wang, et al. 2002, 2003). The reason for this shift in research methodology can be demonstrated best by the case analysis called "The Courtyard-house Syndrome".

The courtyard house, the distinctive Chinese house type, has long been used as the model by which to name almost all houses with one or more inner courts, by professionals as well as by lay people. For instance, there are two courtyard-houses, as shown in Fig.1., that are both called "he-yuan" because of the presence of the key feature of the house, i.e. the court. These two house types look very much the same when their differences are overlooked as trivial. However, triviality as such creates enormous effects when it...
propagates itself into a larger form, making one that is similar become a completely different kind of species as a result.

Let us take a closer look. The two courtyard houses employ the same building elements: the main and accompanying buildings both have the same spatial structure: one-hall with two-chambers, but different in scale and volume. The "trivial difference" as observed in these two courtyard houses lies in the arrangement of building elements. In House X two accompanying buildings are placed as being subservient to the main building, while in House Y they are placed as equal components to the main building to form the inner court. The placement schema presented by House X describes the spatial arrangement principle called "Escorting" (Hu) and that presented by House Y is called 'Encompassing' (He).

As a surprising consequence of this trivial difference at the beginning, two distinctive compounds are produced as the houses grow according to specific arrangement principles, which qualify the sense of being understood as two different types. The house types generated by the "Escorting" move are found almost exclusively in southeast China, and those generated by the "Encompassing" move are typically the forms adopted in central and north China. It is conceivable that these two types have been distinguished by earlier scholars as the Southern Style and the Northern Style based on their locations. However, in the interest of the typological research advocated by this study, it is the genesis origin, not the location, that matters.

2. Schema as Arrangement Move

The aforementioned spatial schema "Escorting" and "Encompassing" present two important messages. First, they are action terms by which geometric form can be produced, and as such, the action terms can be conceived as "arrangement moves" (Wang, 1987) to specify spatial layout not unlike choreographic terms to specify dance movements. Second, they are action terms related to body poses and performances. These body action words have actually been widely used in naming spatial layouts in China since long ago. The etymological relevance as speculated in this study can reveal traces to associate these body-action terms to the anthropomorphic origin of spatial layout, which are quite common in many old civilizations from the east to the west. As a result of the study, there exist 7 major "arrangement moves" to be used as schema for spatial layouts in traditional Chinese houses.

**Etn- "Extention":**
One central hall with chambers on both sides is the basic spatial unit in all Chinese traditional houses, and therefore is the building block to construct large compound houses. This basic unit can be extended from the central hall by adding more chambers on both sides to form a linear structure, which is very much like stretching out one's hands. It is found in a Fujian village where all houses are of this type, and the longest one enjoys up to 11 chambers.

**Etr- "Extrusion":**
The schema involves the arrangement of one main building and two accompanying buildings. The main building is centrally positioned and each companion building is located in such a way as to project out to the front to form a court. Anthropomorphically speaking, this arrangement is the kind of move like stretching one's feet out in front, and this body act is exactly the term used by people in southern Fujian to refer to this schema. Also found in Taiwan is the type with only "one foot" stretching out. The extrusion unit can repeat itself to make very long 'feet', which is also found only in the Taiwanese countryside.

**Pgr- "Progression":**
This move is about the arrangement of main buildings, i.e. the hall houses, along the central axis in a serial manner. The number of halls in a house compound is no more than three, and the type with two hall-houses is popular.
Esc- "Escorting":

This schema refers to the arrangement of positioning accompanying buildings on both sides of the central cluster as two arms to protect the body. The accompanying building as such is named "guarding dragon" in southern Fujian. The central cluster is typically constructed by the Extrusion and Progression move. This Escorting unit, as featured by its long shape made out of many basic spatial units, can repeat in number to form an intensified large compound.

Ifd- "Infolding":

As Escorting refers to the protection from both sides of the central cluster, Infolding is a more intensive protection that will guard from the back towards the front so that the center is surrounded on three sides by strings of accompanying buildings.

Srd- "Surrounding":

While the Infolding move refers to the protection on three sides, Surrounding is the move to complete the closure, although the front side sometimes is left open. What to be surrounded is a core composed of a cluster of houses typically made by the schemas of Progression and Extrusion. The surrounding building can also grow by repeating the same move to form concentric loops. Cases are found in which such loops can consist of three or even more.

Ecp- "Encompassing":

As Surrounding refers to the enclosure with a core body, Encompassing is the schema that also forms an enclosure but with the core empty. The empty core as such is usually used as a private yard if the scale is small or as a public arena when the scale is large. Encompassing move, by repeating itself, can produce complex configurations with a series of courtyard houses clustered from all directions, which may well be able to fit organically to various site conditions. Although very few of this type are found in the south of China, they are quite typical in the north.

### Table: Schemas

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<tr>
<th>Abstract idea</th>
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<th>Physical presentation</th>
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3. Schema as Genesis Language: Coding Types

It is important to note that these schemas, as introduced by the notion of "arrangement moves", should not be conceived as rigid plans of spatial layout; instead, they should be viewed as relatively vague intentions of establishing particular positional relations among spatial elements. The schemas, as illustrated in Fig.2., represent abstract ideas of spatial arrangement and a number of corresponding cases may exist as physical realizations of embedded schema.
It also should be noted that the existing cases might not be as pure as the theoretical construct can enjoy. In many cases the schemas employed are often more than one and interact in rather complicated ways that require closer examination. All existing cases can be coded in terms of schemas, which is not unlike the work of constructing language by means of syntactic rules. Methodologically speaking, coding as such is a way of identifying types. Fig.3. provides a few examples to demonstrate how types are specified by means of schema coding, which are explained in detail as follows.

(1) The first group contains three types that are produced by applying only one schema: Etn, Etr, Pgr and Ecp.

**Type {Etn}**
The Extension case: spaces grow from the central hall towards two sides in a linear fashion. It should be noted that the linear growth of a house may not be qualified as type {Etn} if it does not take the central hall as the reference of development.

**Type {Etr}**
Type {Etr} is a widespread traditional house type in Taiwan and is characterized by its intensive application of Extrusion schema to produce quite long "legs". There exist also "one foot" or "single hand" cases in Tainan, the oldest city of Taiwan. The case under examination presents a stretched hall-house with up to 7 chambers, and two "legs" that are as long as up to 10 rooms, which is not untypical in the countryside of south Taiwan but quite rare in China.

**Type {Pgr}**
Type {Pgr} houses are distributed mainly in the Tong-an area of Fujian and Jinmen island of Taiwan, two places that share vicinity as well as ethnicity. Schema Progression is widely applied to almost every house type in southeast China, which is the key method for building the central clusters of large compounds. There are some cases that have the so-called "pillow-houses" positioned as end pieces of the central axis formed by schema Progression.

**Type {Ecp}**
Encompassing is the schema extensively used in north China, which produces a variety of houses generally known as the "Courtyard House" type. A few interesting cases are found in Zhejiang, south China, which exhibit the flexible capacities of this schema to cope with irregular site configurations.

(2) The second group contains four types that can be coded by one schema as the dominant move and a few schemas that perform minor functions in generating spatial layouts. It is important to know that different types can result through different combinations from the same schema pool.

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Fig.3. Construction Type by Schema
Type \{ Esc (Etr) \}

Type \{Esc (Etr)\} can be viewed as a derivation of Type \{Etr\} and is to be found mostly in the southeastern area of China. Usually only two escorting houses are built to guard the central cluster from both sides, as acknowledged by Type \{Etr\}. There are a few large compounds in Taiwan with up to 6 and 7 Escorting houses on each side. The Escorting schema basically cannot be applied alone, and therefore, plays a minor role in these cases.

Type \{Esc (Pgr)\} (with multi-hall)

Type \{Esc (Pgr)\} is a typical case to demonstrate schema Progression. It is composed of a core cluster with two Escorting houses on each side. The core cluster can be formed either by double halls or by triple halls in serial arrangement along the central axis as presented by Type \{Pgr\}. In the eastern region of Guangdong this house type with a triple-hall core is quite typical, while in the southern Fujian area the double-hall core type is more popular. Despite this difference, they should be regarded as two variations of the same type.

Type \{Ifd (Pgr)\}

This house type is found mostly at the adjoining areas of three provinces, Fujian, Guangdong and Jiangxi in southeast China. The type is characterized by applying schema Infolding that produces a massive built volume to enclose the central cluster typically defined by schema Progression. The Infolding method usually encloses only three sides of the compound.

Type \{Srd (Ifd (Pgr))\}

From the notation it is clear that it is the inner cluster as described by Type \{Ifd (Pgr)\} is surrounded by a ring of built volumes. The demonstration case 14 shows that the outer ring is only half built, and a half-moon shaped pond completes the other half.

(3) The last group contains types that apply more than one major schema simultaneously and in a more integrated manner. Three cases are presented for the demonstration.

Type \{ Pgr/Esc (Etr)\}

This type provides a good demonstration of the building developments following two different directions as specified by schema Progression and schema Escorting simultaneously. The built volumes are increased compound by compound and arranged in progression along the central axis. Each compound is built by two schemas, which can generate more Escorting houses and more Extrusion houses. Different cases of this type are found in central Taiwanese rural areas with a variety of scales and forms.

Type \{Srd/ Esc (Pgr)\}

This type can be construed as a semi-circular volume that is positioned by the Surrounding method to "back-up" the main building body as specified by Type \{Esc (Pgr)\}. The half-moon shaped pond at the front is another distinctive feature of this type that is generally known as "Mount-closure Houses". This type has been regarded as the rigorous model of Chinese geomantic thought. Houses of this type are distributed mostly in the eastern area of Guangdong. A few cases with incomplete form can be found in Taiwan's Hakka communities.

Type \{Srd* (Pgr/ Esc (Etr))\}

This type exists in the area near where Type \{Pgr/ Esc (Etr)\} is located in central Taiwan. It is interesting to note that the Escorting houses are increased outward in a manner to outline the surrounding imagery in an ellipse shape without actually adding surrounding volumes, which is what the asterisk symbol Srd* means. This type presents quite a clear connection with the mount-closure Type \{Srd/Esc (Pgr)\} in Guangdong.

The 7 schemas presented in this study can be viewed as the basic vocabularies to constitute a language capable of describing all built cases in a generative fashion, i.e. it is not only a descriptive language but also a genesis language. The language as such exhibits a few syntactic properties:

1). Schemas such as Extension, Extrusion, Progression, Escorting, Infolding and Surrounding are often mixed with each other when they are applied.
2). Schema Extension exists in almost all house types.
3). Schema Encompassing is almost never combined with any other schema.

4. Modes of Evolution

If the schema system can describe typological structure in terms of layout arrangements, then these schemas are also expected to be able to generate typological variations, which may contain information regarding genealogical linkages among types. Fig.4. presents a few related type families of large compounds primarily generated by schema Extrusion, Progression, Escorting, and Surrounding, which are distributed primarily in southeast China and Taiwan (Fig.4.). Four processes are identified: partialization, adjoining, interbreeding, and deformation, which can be seen as the evolutionary forces underlying the genesis programs that produce typological variations.

(1) Evolution by Partialization

It is particularly remarkable that a certain part of the compound house is taken as an independent schema that can be repeatedly applied, and as a result a new type may emerge. For instance, the semi-circular row house type as illustrated by Case b in Fig.4., is an interesting example by which to demonstrate this evolution process. This semi-circular built form, a typical part of the type known as "Mount-closure Houses", can hardly be found as an independent compound except in the mountain area near the eastern border of Guangdong where there also exists another example of partialization; i.e. the long building produced by Escorting schema is adopted as the unit structure to form a large compound locally known.
as the "Bar House", which is illustrated by Case a in Fig.4.

(2) Evolution by Adjoining
Two separate built volumes may join together as one piece that will constitute a new interpretation of schema. For instance, the "Pillow House" at the very back of the central cluster made out of the Progression schema will adjoin the Escorting houses at both sides of the central cluster to form a continuous volume that characterizes the schema Infolding. This evolutionary process has been clearly demonstrated by the application of schemas {Srd/Esc}, which is indicated by the developments from Family B to Family C in Fig.4.

(3) Evolution by Interbreeding
Two separate schemas may integrate into a new configuration by applying one onto the other. For instance, the house Type {Etr}, a very unique central Taiwanese farm type house, has been repeated by the schema Progression to produce a new type {Pgr (Etr)} to which the schema Escorting can be applied again, and the new house form {Esc/Pgr (Etr)} is created as illustrated by the cases of Family A in Fig.4.

(4) Evolution by Deformation
To deform means to change the shape and appearance rather than the structure and organization. Many cases can easily be found that prove that deformations are primarily due to adaptations to tighter site conditions, such as that the inner courts are squeezed into thin and

Fig.4. Typological Variations Analysis
narrow shapes called "light wells" and then can be widely used as a new vocabulary of form even in areas without constraints of tightness. It should be noted that the merely fitting in of irregular site geometry is not deformation in the true sense. It is the structural re-adjustments, whether squeezing or expanding, caused by the need for contextual adaptations that can have evolutionary power.

5. Towards A New Research Program

As opposed to the previous methodologies based on rule systems, this paper presents schema as a methodical unit for typological analysis. This new approach is of course still in the process of development, and some promising results, as outlined below, encourage further pursuits along this line.

(1) Schema is an abstract idea regarding spatial layout, and as such it can be conceived as an intention-to-form, which means that the schema is an act of positioning with the generative power to produce a range of possible layouts instead of a well-planned rigid form. Based on schema language, house-building can be seen in its most natural sense again, i.e. building is an intentional act of forming. Schema is the intention embedded in building.

(2) By virtue of this abstract intentionality, schema methodology can enjoy, while at the same time also suffer from, a much wider interpretive space in typological analysis. For instance, all cases of Family A, Family B, and Family C in Fig.4. share the layout intention as described by \{Esc (Prg)\}, therefore they all can be regarded as stemming from one root. On closer examination however, there exist significant differences that deserve our attention. For instance, to layout by the same intention of Surrounding, the case of the Mount-closure House type in Guangdong as indicated by \{Srd(Esc(Prg))\} is quite different from the large compound in Taiwan as denoted by \{Srd*(Pgr/ Esc (Etr))\}.

(3) Types travel like animals, but when they inhabit a new environment they evolve like plants. Typological analysis by the schema system reveals interesting chorological information concerning house types. It is observed that migrant types may share similar schemas with their original home country types, but not necessarily the same house form. Very often, migrant types will evolve and develop new typological traits that characterize different schemas. The Taiwanese "Courtyard House" is recognized by its U-shape geometry, the result of a special way of applying schema Extrusion, i.e. Type \{Etr\}, which is a very rare case in its Fujian homeland. Many other house types in Taiwan cannot be found in their corresponding homeland of southeast China either. This finding shows that adaptation to a new context is the main force causing typological evolution. What have been brought to the new land from the homeland are spatial schemas, not physical forms.

(4) To assimilate with the existing built forms in new environments is one major force that drives typological changes of the migrant types. The Type \{Etr\} as mentioned above is atypical in its homeland of Fujian, but the main schema Extrusion is very popular in central and south Taiwan, which can be found not only in small house types but also in large compound types, such as the Family A type in Fig.4. It is reasonable to assume that assimilations by popular schemas have something to do with the practice territory of local builders who favor these schemas.

The schema system, although still in need of further exploration, opens a new program for typological studies. On the one hand, it raises chorological issues as discussed shortly above, and on the other hand, it sheds new light on the traditional typological genealogy by re-conceptualizing the genetic inheritance of built types in terms of intentional acts rather than formal traits.

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