The transformation of Frank Lloyd Wright's Prairie houses into his Usonian houses

Introduction

Frank Lloyd Wright is probably the best known American architect and certainly one of the most prolific architects of his time. Born in 1867, his architectural career spanned some seventy years – from 1889, when his first independent project was completed, to 1959, the year he died. Two of his most impressive series of works are the Prairie houses of his early career and the Usonian houses of his later career. While much has been written about these two very distinctive styles of architecture, formal studies of the designs of Prairie and Usonian houses are rare; analysis of composition is often subordinated to discussions of innovation in the use of materials and construction techniques.

Still less has been said about relationships between the design of Prairie houses and the design of Usonian houses. John Sergeant’s spatial analysis of Usonian houses, and his comparison of these houses with Prairie houses, draws on earlier analyses of Wright’s work by Grant Manson and by Richard MacCormac. Manson was the first to look closely at the relationship between Wright’s Froebel kindergarten education and his later architectural work. MacCormac carried the Froebel-Wright connection further by likening Wright’s Prairie and other early houses to the disciplined play of Froebel blocks within rectilinear grids – an activity that Wright was instructed in as a child. Sergeant’s subsequent analysis, like that of MacCormac, focuses on the role of the grid, not only in Wright’s Prairie designs, but in his later Usonians as well. However, much is left unsaid about other, very basic aspects of composition, for example, the spatial relationships between the various building elements that occupy grids. Sergeant’s exploration of relationships between Prairie and Usonian houses is insightful yet relatively informal; Usonian
houses are described as a simplification and loosening of the planning grids of Prairie houses.

In this study, Wright's Prairie architecture, his Usonian architecture, and relationships between these two styles are approached in a different and fundamental way. Prairie houses and Usonian houses are characterized in terms of shape grammars. Usonian houses are further characterized as transformations of Prairie houses by showing how a grammar for Prairie designs can be transformed straightforwardly into a grammar for Usonian designs. Basic, but largely unrecognized, continuities from the design of Prairie houses to the design of Usonian houses are discussed.

From butterflies to polliwogs: the language of the Prairie transformed

Wright's Prairie houses have often been described as cruciform or butterfly-shaped in plan. Figure 8.1 shows the main floor and the upper, bedroom floor plans of five of these houses: the Henderson (1901), Willets (1902), Roberts (1908), Baker (1909), and Robie (1909) houses. A shape grammar that defines a language of these and other Prairie-style houses has been given in a very elucidating and original study of the Prairie style by Hank Koning and Julie Eizenberg. Based on Wright's compositional theories and produced works, Koning and Eizenberg's grammar generates Prairie houses in three dimensions. Only the most essential aspects of the designs of these houses are considered; many details considered superficial are ignored.

Prairie designs are generated by the Koning and Eizenberg grammar in two stages. First, basic compositional forms are defined with basic composition rules. Second, basic compositional forms are elaborated and ornamented in various ways with ornamentation rules to produce complete designs.

Basic compositional forms represent the main level of a house and are built up in terms of simple spatial relations between three-dimensional Froebel-type blocks. These blocks correspond to the basic volumetric spaces of Prairie houses. The dimensions of the blocks can vary to correspond to dimensional differences of spaces in different houses. Blocks are distinguished functionally as either living zones or service zones. Living zones include living rooms, dining rooms, libraries, and so on. Service zones include kitchens, servants' quarters, main floor bedrooms, and so on. The generation of a basic compositional form begins with basic composition rules for locating a fireplace, considered by Wright to be the focal point of a Prairie design. A living zone is then added in relation to the fireplace and a service zone added in relation to the living zone to form the rectangular core unit of a Prairie design. To complete a basic composition, the core unit is extended by adding
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Henderson house (1901)

Baker house (1909)

Willetts house (1902)

Robie house (1909)

Roberts house (1908)

smaller living and service zones (the wings of the butterfly) to it. Ornamentation rules then apply to articulate and elaborate basic compositional forms by adding upper stories, basements, roofs, porches, terraces, and other interior and exterior details.

The Koning and Eizenberg grammar contains ninety-nine rules. Basic composition rules apply to produce eighty-nine different basic compositional forms; these can be ornamented in various ways to produce over two-hundred final designs. Figure 8.2 shows a simplified derivation of a Prairie house design using the

8.1

The plans of five Prairie houses designed by Wright. Both the main floor and the upper, bedroom floor plans are shown.
The main stages of the derivation of a new Prairie-style house (the "Stiny" house) using the Koning and Eizenberg shape grammar. A more detailed rendering of the exterior of the house is also shown. Drawing, courtesy of Hank Koning and Julie Eizenberg.
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The basic compositions of Prairie houses provide the basis for the basic compositions of the later Usonian houses, in particular the L-shaped or, what Wright called polliwog (tadpole), designs typical of this style. Like the basic composition of a Prairie house, the basic composition of a polliwog Usonian consists of a two-zone core unit. One zone of the core unit is an open-plan living zone or body that incorporates living, kitchen, and dining areas; the other zone is a bedroom zone or tail that includes bedrooms and bathrooms. The core unit is sometimes extended by adding smaller living or bedroom zones to the body or tail. The logical center of a Usonian design is a small area located in the hinge of the L-plan that Wright termed the work space. Analogous to the central fireplace of a Prairie house, the work space is always contained within the living zone and consists of a kitchen area with an adjacent fireplace facing out toward the living room. Designs of Usonian houses are completed by ornamenting and articulating basic compositions in a variety of ways. Unlike the Prairie houses, however, many USons are only one level. In the words of Wright, Usonian designs are summarized thus:

A Usonian house if built for a young couple, can, without deformity, be expanded, later, for the needs of a growing family. As you can see from the plans, Usonian houses are shaped like polliwogs - a house with a shorter or longer tail. The body of the polliwog is the living room and the adjoining kitchen - or work space - and the whole Usonian concentration of conveniences. From there it starts out, with a tail: in the proper direction, say, one bedroom, two bedrooms, three, four, five, six bedrooms long ... The size of the polliwog's tail depends on the number of children and the size of the family budget.

Figure 8.3 shows the plans of six, one-level polliwog USons: the Jacobs (1936), Lusk (1936), Rosenbaum (1939), Newman (1939), Garrison (1939), and Pope (1940) houses.

The differences between Prairie and Usonian houses are, to a certain extent, reflections of changes in living standards between the times in which they were built - Prairie houses during the early 1900s and Usonian houses during the years before and after World War II. The Usonian house was conceived partially in response to the urgent need for low-cost housing during the thirties. Hence, the core unit of a Prairie house which formed only a part of an expanded design became, in the case of many USons, the whole of a design. Extensions to the core unit of a Usonian house were the exception, for larger or more affluent families, rather than the rule. Since servants were no longer a common fixture of households, the kitchen, which was segregated from the living and social areas in a Prairie house, became integrated into the living area of a Usonian. A host or hostess could cook as well as entertain and socialize from this new centralized work space. The adjacent fireplace, however, remained a focal point of a design.
8.3 The plans of six Usonian houses designed by Wright.
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The design of Wright's Usonian houses and the design of his earlier Prairie houses can be described with the two shape grammars illustrated in figure 8.4. The Prairie grammar is taken from Koning and Eizenberg's grammar. The Usonian grammar is new. The initial shape, rules, and final state of each grammar are separated into basic composition rules and ornamentation rules. Basic composition rules and ornamentation rules are further subdivided into categories of rules with more specific compositional functions. Rules in the Prairie grammar and rules in the Usonian grammar that are identical or have corresponding compositional functions are shown in the same row. When a rule in the Prairie grammar corresponds to more than one rule in the Usonian grammar, they are connected by lines as shown.

The Prairie grammar

The Prairie grammar is a simplified version of Koning and Eizenberg's earlier grammar. Rules from the Koning and Eizenberg grammar have been translated into the standard format for shape grammars described in chapter 3. Only those rules that have counterparts in the Usonian grammar are given. These include translations of most of the basic composition rules from Koning and Eizenberg's grammar but none of the ornamentation rules. Readers may refer to Koning and Eizenberg's grammar for omitted basic composition rules (these include, for example, rules for beginning a design with a double-hearth fireplace and rules that allow different zones in a design to interpenetrate one another) and for ornamentation rules. The basic composition rules that are included here generate a few new possibilities for basic compositions not generated by Koning and Eizenberg's rules. These new basic compositions are allowed since they appear to satisfy the same stylistic criteria satisfied by other basic compositions.

The Prairie grammar shown here, like Koning and Eizenberg's grammar, is a parametric shape grammar. The lengths and widths of blocks in the rules are allowed to vary so that designs of different dimensions can be generated. For example, the length of the longer side of a living or service zone block that forms a part of the core unit in a basic composition can vary between one to four times the length of the adjacent side. The height of a core unit block, however, is fixed. The living and service zone blocks added to a core unit to extend a basic composition must each be smaller than the core unit but not less than one-quarter of its size.

The functions of different zones in a Prairie design are indicated by different grey tones as in the Koning and Eizenberg grammar. A light grey tone indicates a living zone; a medium grey tone indicates a service zone.

The initial shape of the Prairie grammar consists of a fireplace in a state 0. Rules 1 through 8 depict all possible ways of placing a
### 8.4

A shape grammar that generates Prairie houses and a shape grammar that generates Usonian houses.
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PRAIRIE GRAMMAR

USONIAN GRAMMAR

9:

10:

11:

12:

13:

completing the core unit: adding a service zone (Prairie rules) or a bedroom zone (Usonian rules)

14:

15:

16:

obligatory extensions (Prairie rules) or optional extensions (Usonian rules) to the core unit

8.4 continued
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PRAIRIE GRAMMAR

USONIAN GRAMMAR

BASIC COMPOSITION RULES

extensions (con't)
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PRAIRIE GRAMMAR

USONIAN GRAMMAR

25:

26:

27:

28:

extensions (con’t)

see Koning and Eizenberg grammar for Prairie basic composition rules not shown here

29:

30:

31:

32:

33:

34:

35:

36:

see Koning and Eizenberg grammar for Prairie ornamentation rules not shown here

numbering of rules is approximate after omitted Prairie basic composition rules

extending the “hinge” of the core unit

8.4 continued
interpenetrating zones

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living zone in relation to the fireplace. The spatial labels • and ○ marking the corners of living zones are used subsequently to distinguish different ways of adding other zones to a living zone.

Rules 9 and 10 specify the two ways that a service zone can be added to a living zone to form the rectangular core unit of a Prairie.
design. In rule 9, a service zone is added to the longer side of a living zone; in rule 10, a service zone is added to the shorter side of a living zone. The labels $\bullet$ and $\circ$ distinguish these two different relationships between the living and service zone of a core unit.

Extensions to the core unit are obligatory. These are determined by rules 14 through 29. Rules in this group add smaller living and service zones to the living and service zones of the core unit. Rules 14, 15, 22, and 23, define all possible ways of adding a smaller living zone to the living zone of a core unit; rules 17 through 20 and rules 25 through 28 define all possible ways of adding either a smaller service zone or a smaller living zone to the service zone of a core unit. The labels $\bullet$ and $\circ$ control the placements of extensions to the two possible configurations of living and service zones forming a core unit. Rules 16, 21, 24, and 29 erase the labels $\bullet$ and $\circ$ associated with living and service zones after these zones have been extended. Applications of extension rules are ordered by state labels so that extensions to both the living and service zones of the core unit are obligatory.

The final state of the grammar is variable; it may be any state greater than or equal to 6.6

Figure 8.5a shows how the basic composition rules of the Prairie grammar apply to derive the basic compositional form of Wright's Robie house. Figure 8.5b shows two other basic compositions generated by these rules. One is the basic compositional form of the Roberts house; the other is the basic compositional form of the Henderson, Willets, and Baker houses.
The transformation of the Prairie grammar

The shape grammar for Prairie houses can be transformed into a shape grammar for polliwog Usonians, as well as other new grammars, by deleting, changing, and adding rules. In the transformation, all of the Prairie ornamentation rules and some of the Prairie basic composition rules are deleted, the remaining Prairie basic composition rules are changed, and new, Usonian ornamentation rules are added. Of the three grammatical transformations, rule change illustrates most strikingly the close relationship between Prairie and Usonian designs.

Rule deletion: Prairie basic composition rules 1, 3, 4, 6, 8, 14, 17, 20, 22, 25, 28, and all other basic composition and ornamentation rules from the Koning and Eizenberg grammar, not given here, are deleted.

Rule change: The remaining Prairie basic composition rules are changed by changing the spatial relations and labels that define these rules. Changes to spatial relations and labels are as follows:

Spatial relations

Between a fireplace and a living zone (rules 2, 5, 7): These spatial relations are changed by both repositioning shapes and introducing new shapes. The fireplace is moved from the border of a living zone into the interior of a living zone and, at the same time, is changed into a fireplace/kitchen or work space.

Between a living zone and a service zone in a core unit (rules 9, 10): These rectangular, core unit spatial relations are changed into L-shaped and other new kinds of core units by repositioning shapes. New core units are produced by rotating 90° either a living or service zone in either of the two types of rectangular Prairie core units. This change is the most prominent compositional change in the transformation of Prairie designs into Usonian designs.
The transformation of Frank Lloyd Wright's Prairie houses designs and is closely related to the change in state labels described below. Changing the rectangular core unit of a Prairie house into an L-shape allows extensions to be added to it optionally, that is, to one, both, or neither of the zones in it, without disturbing the integrity of the plan ("without deformity," as Wright said). Any extension to an L-shaped core unit simply elongates either the body or the tail of the polliwog. Optional extensions to a rectangular core unit, on the other hand, would produce a lopsided, unbalanced plan whenever only one zone is extended – a plan analogous in form to a butterfly with only one wing.

In addition to the change in location, the service zone in a Prairie core unit, which may include bedrooms and bathrooms, changes functionally to become a bedroom zone in a Usonian core unit, which includes only bedrooms and bathrooms.

_Between a zone in a core unit and an extension (rules 15, 18, 19, 23, 26, 27):_ These spatial relations are changed by repositioning shapes. Extensions are repositioned so that core unit zones and extensions are always aligned along their longer sides.

The spatial relation changes outlined above are illustrated in figure 8.6. Spatial relations are numbered to correspond to the basic composition rules they define. The change rules that transform Prairie spatial relations into Usonian spatial relations are also shown. The new Usonian spatial relations are used to define the new Usonian basic composition rules depicted in figure 8.4. The change rules shown can also apply to Prairie spatial relations to produce new spatial relations other than the Usonian spatial relations illustrated. These other spatial relations define other new rules, leading to other new grammars. Other spatial relations are discussed in the following section.

_Spatial labels:_ In conjunction with the spatial relation changes described above, the spatial labels • and ○ marking the corners of core unit zones are changed as shown in the new Usonian basic composition rules illustrated in figure 8.4. As in the Prairie grammar, these labels distinguish different ways that zones may be added to core unit zones.

_State labels:_ The state labels associated with extension rules 16, 21, 24, and 29 of the Prairie grammar are changed as shown in the new Usonian grammar. These changes make the application of extension rules optional rather than obligatory.

_Rule addition:_ New ornamentation rules (rules 35 through 58 in figure 8.4) are added. These rules are described in the next section.

Rule deletion, rule change, and rule addition apply to the Prairie grammar to produce a family of new grammars. Included in the family is a grammar that defines a language of polliwog Usonian houses. This is the grammar shown in figure 8.4.
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2. Changing the spatial relation between a fireplace and a living zone.

4. Changing the spatial relation between a living zone and a service zone in a core unit.

8.6 Changing Prairie spatial relations into Usonian spatial relations.
The transformation of Frank Lloyd Wright's Prairie houses

changing the spatial relation between a zone in a core unit and an extension

Prairie spatial relations

change rules

Usonian spatial relations
The Usonian grammar

Although the outward appearance and spatial organization of Usonian houses seems substantially different from that of Prairie houses, the underlying composition of Usonian design is closely related to that of Prairie designs. Parallels between the two styles are reflected in analogous rules of composition in Usonian and Prairie grammars.

In the Usonian grammar, as in the Prairie grammar, designs are generated by first defining basic compositional forms and then ornamenting these forms to produce complete designs. The generation of a Usonian basic composition begins with a place/kitchen or work space – the initial shape of the grammar. A living zone is then placed in relation to the work space in any of the three ways specified by rules 2, 5, and 7. The work space is always located in the upper half of a living zone, the fireplace always parallel to a side of the living zone. The spatial labels and marking the corners of living zones are used subsequently to distinguish different ways of adding other zones to a living zone. The core unit of a Usonian design is completed by adding a bedroom zone, containing from one to three bedrooms and all bathrooms, to the living zone. Rules 9 through 13 specify the five different ways an L-shaped Usonian core unit can be formed.

Optional extensions to the core unit are determined by rules 15, 16, 18, 19, 21, 23, 24, 26, 27, and 29. Application of either 15 or 23 adds a smaller living zone to the living zone of a unit. This small living zone extension is used as either a workshop or a study. Application of one of rules 18, 19, 26, or 27 adds a smaller bedroom zone or a smaller living zone to the bedroom zone of a core unit. The small bedroom zone extension includes one or two additional bedrooms and possibly a bathroom. The small living zone extension is used as a workshop or a study and is sometimes converted into a bedroom. The labels and in rules 15, 18, 19, 23, 26, and 27 control the placement of extensions. Rules 16, 21, 24, and 29 apply to erase the labels and . Because the left-sides of these rules have no state label, the rules can be applied to a design in any state; that is, to designs with core unit extensions (in states 3 or 5) or without core unit extensions (in states 2 or 4). Applications of extension rules are thus ordered by state labels so that extensions to a Usonian core unit are optional rather than obligatory as they are for Prairie core units.

The basic composition rules of the Usonian grammar derive basic compositional forms in much the same way that basic composition rules of the Prairie grammar apply to derive basic compositional forms. In particular, the recursive structure of the Usonian basic composition rules is isomorphic to
recursive structure of the Prairie rules from which they are derived. Thus, despite differences in the spatial relations and the labels that define Prairie and Usonian basic composition rules, the ways Prairie basic compositions and Usonian basic compositions are generated are equivalent.

Figure 8.7 gives a catalogue of all the different basic compositional forms that can be generated by the Usonian basic composition rules. The dimensions of each of these forms can be varied to determine forms with different proportions in the same ways that the dimensions of Prairie basic compositional forms can be varied (see p. 224). Included in the catalogue are the basic compositions of the Usonian houses illustrated in figure 8.3. These are identified by name. All other basic compositions are new.

A line between a living zone and a bedroom zone in a basic composition as illustrated in figure 8.7 approximates either a real or implied boundary between spaces used for different purposes; in other words, it does not necessarily correspond to an actual wall or partition. A line between a living or bedroom zone and its extension frequently does correspond to a physical boundary such as a wall, partition, or secondary fireplace.

When the living zone and bedroom zone in a core unit overlap, as in basic compositions 1 through 6, then a part of the living zone and a part of the bedroom zone are contained within the same space in the hinge of the plan. In the Rosenbaum house, for example, both the kitchen and master bathroom are contained in this area. When the living zone and bedroom zone are separated as in basic compositions 13 through 18, 25 through 30, 37 through 42, and 49 through 54, then the intervening space could be either a courtyard, terrace, or other open or semi-enclosed space. For example, in Wright’s Adelman house of 1953—a Usonian house close in plan to Wright’s L-shaped Usonians shown here—two separate areas of the house are linked by an outdoor terrace.

Usonian basic compositional forms are developed further with ornamentation rules 35 through 58 in the Usonian grammar. All of these rules are optional and are analogous in purpose, but not in form, to ornamentation rules in the Prairie grammar. Although Prairie houses and Usonian houses are closely related in basic compositional form, their designs rapidly diverge with further embellishments.8

Rules 35 and 36 apply to add a living zone, used as either a workshop or a study, to the hinge of an L-plan. Because the state of a design changes when rule 35 is applied, the rule can be applied only once. The area of the space added by rule 36 may vary between one-quarter to one-half the area of the living or bedroom zone in the core unit. The length of any side of this space may vary between one to two times that of the adjacent side.

Rules 37 through 41 each apply to interpenetrate one zone in a
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8.7 Usonian basic compositions.
design with another zone. The depth of interpenetration is always less than one-third the length of the interpenetrating zone. If any one of these rules is applied to interpenetrate a zone of a core unit with another zone of the core unit, then one of rules 42, 43, or 44 can be applied to reattach an extension to the interpenetrating zone.

Rules 45 through 48 add spaces to extensions. In rule 45, the larger space is a zone of a core unit and the smaller space is an extension. The label ▽ marks a side of an extension as shown. Because the state of a design changes when rule 45 is applied, the rule can be applied only once. In rules 46, 47, and 48, the area of the added space may vary between one to one-half the area of the extension it adjoins. The length of any one of its sides may vary between one to two times that of the adjacent side. Notice that a bedroom zone can never be added to a living zone.

Secondary fireplaces may be added to designs with extensions by applying rules 49 through 55. In rule 49, the larger space is a zone of a core unit and the smaller space is an extension. The label • can be placed anywhere along the line that separates a core unit zone and its extension, but not at its endpoints. The extension may or may not interpenetrate the adjoining zone. Rule 50 replaces the label • with a single-hearth fireplace; rule 51 replaces the label • with a single-hearth fireplace in a corner of a zone.

Rules 52 through 55 create different double-hearth fireplaces from single-hearth fireplaces. Whenever a fireplace is added, the line or lines it overlaps are erased thus preventing fireplace rules from being reapplied in the same place.

Finally, rules 56, 57, and 58 each apply to cut off or inflect an exterior corner of any zone in a design. The dimensions of the inflection can vary. The total area of inflections to a zone cannot be greater than one third the original area of the zone. These rules apply recursively to produce the interior alcoves and niches and undulating exterior facades characteristic of polliwog Usonians.

The final state of the Usonian grammar is variable; it may be any state greater than or equal to 6.

A design is in the language generated by the Usonian grammar whenever it meets the usual provisos and whenever all areas in a design distinguished by grey tones are completely bounded by lines. This latter, supplementary proviso ensures that designs generated by inappropriate applications of some of the ornamentation rules are not included in the language.

In figure 8.8, a derivation of Wright's Garrison house is illustrated. Basic composition rules apply in the first five steps to generate a basic compositional form. Ornamentation rules are then applied to produce the final design. The final designs for the Jacobs, Lusk, Newman, Rosenbaum, and Pope houses, produced by applying ornamentation rules to appropriately dimensioned basic compositions, are illustrated in figure 8.9.
2.8 A derivation of the Garrison house.
The final designs of the Jacobs, Lusk, Newman, Rosenbaum, and Pope houses.

The Usonian grammar is only one of several grammars produced in the transformation of the Prairie grammar. Because the change rules illustrated in figure 8.6 determine new spatial relations other than the ones shown, other new rules can be defined for other new grammars. For example, the two change rules that apply to the rectangular core unit of a Prairie design can apply to produce new spatial relations other than the L-shaped relations shown in figure 8.6. Figure 8.10 shows some of the other possible spatial relations that result from different applications of these two change rules. Each spatial relation is produced by rotating both the living and service zone in a Prairie core unit, rather than just one of these zones as in figure 8.6. Spatial relation 1 corresponds to some of Wright's early one-zone Usions, spatial relation 2 corresponds roughly to what Sergeant calls an "in-line Usonian." Other spatial relations can be considered the bases for completely new Usonian or other style compositions.
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8.8 A derivation of the Garrison house.
Discussion

This study illustrates again how the formal model described in Part II can be used to elucidate changes in styles. Wright’s Prairie style is described very easily in terms of rules based on spatial relations between block-like shapes. His later Usonian style is described as a transformation of Prairie rules. Central to the transformation are the changes in the spatial relations and the ordering of rules for the basic composition of Prairie design. These changes are unexpectedly simple yet they have very sophisticated consequences – they are the basis for rules for a distinctly different style.

The way that the spatial relations for Prairie designs are changed into spatial relations for Usonian designs illustrates one of the ways for changing spatial relations discussed in chapter 9. The shapes in each spatial relation for a Prairie basic composition are simply rearranged to produce a Usonian spatial relation; new shapes (except for the work space) are introduced. Recalling however, that Wright’s stylistic innovations also included the introduction of new shapes. (See figure 5.8a and pp. 88, 91). The plans of three houses Wright designed around the same time as the Usonians discussed here – the “Life,” Jester, and Sundt houses – have distinct stylistic characters. The stylistic differences between these houses, though, are essentially the result of introducing new shapes into a fixed arrangement of shapes.

Descriptions of styles and stylistic changes are always relative, and are biased in the way some aspects of styles are highlighted while others are ignored. Certainly, Koning and Eizenberg’s characterization of Wright’s Prairie houses as arrangements of blocks around a central fireplace is very unique. Nonetheless, it is compelling. This characterization is perhaps even more plausible now since it can be shown how block arrangements for Prairie houses are easily transformed into block arrangements for Usonian houses. It would be interesting to see how the very different, earlier analyses of Prairie houses as projections of two-dimensional planning grids could be placed as firmly and explicitly in the tradition of Wright’s other work.
Other spatial relations between living and bedroom zones in a core unit that result from different applications of the change rules shown in figure 8.6

Discussion

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The way that the spatial relations for Prairie designs are changed into spatial relations for Usonian designs illustrates one of the ways for changing spatial relations discussed in chapter 5. The shapes in each spatial relation for a Prairie basic composition are simply rearranged to produce a Usonian spatial relation; no new shapes (except for the work space) are introduced. Recalling, however, that Wright's stylistic innovations also included the introduction of new shapes. (See figure 5.8a and pp. 88, 91). The plans of three houses Wright designed around the same time as the Usonians discussed here—the "Life," Jester, and Sundt houses—have distinct stylistic characters. The stylistic differences between these houses, though, are essentially the result of introducing new shapes into a fixed arrangement of shapes.

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The three case studies of Part III bring up important, but not often discussed, issues regarding the limitations and potentials of shape grammars and grammatical transformations in studying individual styles and stylistic change.

Any analysis of a style with a shape grammar is a theory—particularly, retrospective view—of the designs in that style. That view may or may not have anything to do with the way those designs were originally conceived or with the process by which they were made. When dealing with historical material and limited supporting information, it is often impossible to know whether a shape grammar corresponds to historical fact. Even with contemporary material and a living designer, it may still be difficult to know definitively whether a grammar corresponds to the designer’s own conception of his or her designs. Designers are not always willing or able to recount the true origins and methods of their work. Any analysis of a stylistic change using grammatical transformations has the same kind of uncertainties.

Yet, the purpose of most grammars developed thus far has not been to describe or even to conjecture about the historical genesis and actual making of designs, but simply to describe the designs themselves. The more compelling the grammar, the more it would seem likely that the grammar corresponds to historical reality, but there is usually no presumption and certainly no guarantee that it does. Without a definite historical or cognitive basis, however, the relevance of shape grammars to historians and designers is no less significant. A convincing description of a style with a shape grammar points to the existence of some sort and some degree of structure (including, possibly, a lack of structure) underlying designs in that style. Similarly, the description of a change in style with grammatical transformations points to the existence of some kind of structure underlying that change.
Related to this work is an earlier, 1989 paper in which the representation of aspects of form, other than purely spatial ones, is addressed. In this paper by the author, the shape grammar formalism is extended to include the representation of qualities of form such as color, texture, material, function, and so on. With this extended formalism, designs are described with rules made up of different pictorial elements used alone or in combination with one another: lines in two or three dimensions (as in standard shape grammars), colored (or other quality-defined) planes in two or three dimensions, and colored (or other quality-defined) solids in three dimensions.

A still broader generalization of shape grammars was discussed in chapter 2. Description grammars or schemes allow designs to be described in nonpictorial, verbal ways as well as pictorial ways. With description schemes, meanings and determinants of style and stylistic change that may be addressed more appropriately with words, can be treated with the same formal clarity used here to treat spatial form.

The study of style and stylistic change is undeniably complex and difficult. More work is needed to realize the full promise of the formal systems proposed in this book and in the research described above. Yet, even in the work done so far, many of the varying concerns and ideas about style and change are beginning to be brought together more clearly, new and exciting ways of thinking about these ideas are being made possible.
Transformations in design

Whether or not a shape grammar matches the original thoughts or activities of a designer, the grammar demonstrates, at the very least, that those thoughts or activities (whatever they may have been) led to designs with the particular properties described by the grammar. At the very most, the grammar may suggest, by its simplicity or intuitiveness, that the designer's original thoughts or activities were the same or equivalent in structure to the structure manifested by the grammar. For example, ancient Greek potters may not have worked by the rules exactly as defined in chapter 6, but may have used a similar or equally systematic approach in order to produce designs with the simple regularities revealed by the grammars. Any claim stronger than this suggestion, however, could probably not be proven.

Nonetheless, even if a grammar is completely "false" from a historical point of view, the grammar may be just as accurate in the classification of works chronologically or geographically or in the prediction of unknown, missing, or new works — and, in that sense, of equivalent value — as a grammar that is historically "true." For designers, the historical truth of a grammar or grammatical transformations may be irrelevant. The knowledge gained about designs with a grammar or transformations can suggest many new creative strategies and ideas that can be employed in future design work, regardless of historical facts.

Another issue concerning the limits of shape grammars is raised by this study. Here, the examination of style and stylistic change is restricted to the study of form and, within the framework of grammars, to the study of one particular aspect of form and one particular representation of form. To what extent can other dimensions of form, and more generally, of style and change, be explored with the kind of formal rigor applied in the work here? Recent and ongoing research suggests that the bounds on what is possible to represent, describe, and know formally — in particular, with grammars — are broader than might be supposed.

For example, shape grammars as originally conceived represent form in only one way, that is, with lines. Although line representations of form are common and traditional, other ways of representing form are equally valid, even cultivated within various movements in the history of art and architecture. Whereas lines enjoyed a special status during the Renaissance, planes were promoted by De Stijl artists and architects, and solid volumes by the modern movement in architecture. In a 1991 paper, George Stiny described an important generalization of shape grammars in which designs can be described using any of these different representations. The representations that can be encoded in the rules of a shape grammar are chosen from a hierarchy of spatial elements used alone or in combination with one another: points in two or three dimensions, lines in two or three dimensions, planes in two or three dimensions, and solids in three dimensions.
9 Vantongerloo's parallel division rule is derived from his perpendicular division rule, and Glamer's oblique division rule is derived from his rectangular division rule in essentially the same way—by rotating dividing lines. See pages 182 and 203.

10 Rules 9 and 19 could be reintroduced in stage IV by rule addition rather than by rule change. However, rule addition would not point out the relationship between rules 8 and 9 and the relationship between rules 18 and 19.

8 The transformation of Frank Lloyd Wright's Prairie houses into his Usonian houses

1 J. Sergeant, Frank Lloyd Wright's Usonian Houses (New York, 1976), 143–146.


4 Koning and Eizenberg, "Language of the prairie."


6 A variable state of 6 or more makes all ornamentation rules not shown in figure 8.4 optional. In the Koning and Eizenberg grammar, some ornamentation rules, such as those for adding roofs, are obligatory. However, since these rules are not specified in the grammar given here, a more exact range of final states is not specified. Rather than leaving the variable final state undefined, it is defined here as 6 or more. Unornamented basic compositions are thus included in the language defined by the Prairie grammar.

7 Determining which Prairie spatial relations or rules are changed into Usonian rules is arbitrary to a certain extent. For example, any one of the Prairie spatial relations between a core unit zone and an extension could be changed into a comparable Usonian spatial relation by repositioning shapes in the appropriate way. The rule changes defined here are generally the simplest ones for transforming Prairie rules into analogous Usonian rules.

8 The Usonian ornamentation rules given here are not as detailed as the Prairie ornamentation rules given in the Koning and Eizenberg grammar. Basically, only those ornamentations observable in plan are included; variations in ceiling heights, roofs, and so on are not described.

9 Sergeant, Usonian Houses, pp. 52–58.

Postscript


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