



# Bauhaus Internationalism to College Town Modernism

## Exploring Bauhaus Culture in Hajjar's Hybrid Architecture

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**Abstract.** The purpose of this study is to analyze William Hajjar's single-family houses in State College, PA, and compare them with the European modernist work of Walter Gropius and Marcel Breuer in the United States. This analysis is performed using shape grammars as a computational design methodology. Hajjar was a member of the architecture faculty at the Pennsylvania State University, a practitioner in State College, and an influential figure in the history of architecture in the area. Shape grammars are used specifically to verify and describe the influences of Bauhaus/European modernism on Hajjar's domestic architecture. The focus is on establishing Hajjar's single-family architectural language and comparing it to the architectural language of Gropius (Gropius-Breuer partnership) as the founder of the Bauhaus architecture and a prominent practitioner in introducing European modernism to American architecture students in the mid-twentieth century like Hajjar.

**Keywords:** Shape grammar · Modern architecture · Bauhaus modernism · William Hajjar · Walter Gropius

## 1 Introduction

In documenting examples of mid-century modern architecture in State College, PA, home of Penn State's University Park campus, the authors discovered that many of the single-family houses in the area mix formal and functional features typical of European modern architecture with those of traditional American architecture. Further, many of these houses were designed by William Hajjar, a faculty member at Penn State, or his followers in the mid-twentieth-century period. Hajjar was a researcher—mainly in the area of passive energy and energy efficiency—and a successful practitioner who designed and built thirty-two single-family houses in the vicinity of the University Park campus. His work in the area may be unique to a certain kind or practitioner in a certain place and time—i.e., to architecture faculty producing single-family houses in American college towns in the mid-twentieth century.

Many such faculty members who practiced modern architecture—or a hybrid modern-traditional architecture—in college towns throughout the US during this period had studied at American schools at a time when they were moving away from a

longstanding focus on the Beaux-Arts toward a new focus on European modernism instead. Of these schools, which included the Illinois Institute of Technology (IIT), the Massachusetts Institute of Technology (MIT), and Harvard's Graduate School of Design (GSD), with the latter leading the way in championing the new European style, becoming the nation's most prominent school training students in modernist architecture. With the appointment of Walter Gropius, founder of the Bauhaus School, as director of Harvard's Department of Architecture, the process of introducing American students to European modernism had officially begun.

Except for Harvard and the Armour Institute of Chicago, the latter of which was led by Mies van der Rohe from 1938 to 1959 and later became IIT, most U.S. architecture programs remained under the Beaux-Arts system of education (or alternatives) until after World War II. The fact that the GSD and the Armour Institute were the two pioneer schools in training students according to modernism demonstrates the importance of Gropius (and Breuer) and van der Rohe to architectural design in the United States and likewise the importance of the Bauhaus to the country's architectural pedagogy.

While many other schools continued to focus on the Beaux-Arts, some individual architecture professors and even entire architecture programs followed Gropius and Mies by teaching students according to the principles of modern architecture. Among the professors was Lawrence Anderson at MIT, and with the appointment of William Wurster as Dean of architecture in 1945, MIT became the third major program to promote modernism [1]. As Alofsin notes, Anderson, '*a longtime bastion of the French approach,*' was '*instrumental in bringing in modernist thinking*' [2]. Anderson was hired by MIT in 1933 and served as head of the department from 1947 to 1965 and as Dean of the school from 1956 until his retirement in 1972. He was one of a few instructors at MIT in the 1930s who pushed the school's teaching philosophy toward modernism. In addition, he introduced a new system to review the students' work by bringing outside critics to MIT. Gropius and Breuer were among those frequently invited to MIT for this purpose, such that MIT students (including Hajjar) were introduced to Gropius's philosophy of modern architecture [3].

Anderson was especially interested in Scandinavian modernism. With Wurster, he paid a visit to the great modern Finnish architect and designer, Alvar Aalto in the late 1930s and secured Aalto's appointment as a Research Professor in Architecture in 1940 [4]. Anderson worked hard to bring a modern outlook to the MIT program, and in 1939 (with his colleague, Herbert Beckwith) he designed one of the first modernist buildings on an American campus, i.e., MIT's Alumni Swimming Pool [2]. Most probably, Anderson, as Hajjar's advisor, was responsible for pushing him toward European modernism/Bauhaus internationalism introduced to American architectural students by Gropius and Breuer.

To verify and describe the influences of Bauhaus internationalism on the work of Hajjar in State College, PA, this study offers an investigation of the faculty-practitioner's hybrid architecture by comparing and contrasting it with Gropius's architecture, with a focus on single-family houses produced by the Gropius-Breuer partnership in the United States. Via computational design methodology, this comparison will provide information to serve as a basis for determining the nature of

Hajjar's single-family architectural language including by verifying and describing the influence of Gropius-Breuer's architectural language.

## 2 Methodology

This paper is part of a larger study undertaken with the purpose of verifying and describing the hybrid expression of European modern and American traditional architecture in Hajjar's work in State College, PA. The larger study is based around five central steps: (1) tracing Hajjar's life and practice to identify likely influences on his work; (2) developing a shape grammar for the houses Hajjar designed in the State College area; (3) identifying or developing grammars for those influences; (4) comparing Hajjar's grammar to the grammars of these influences in order to determine the nature of these and the likely impact of each on Hajjar's work; and (5) identifying aspects of the social and technological context that may explain these influences—i.e., trends in regard to lifestyle and availability of materials and technologies. Whereas a previous paper [5] described Hajjar's single-family architecture by developing a grammar of his work, the focus of the current paper is on studying the influence of Bauhaus internationalism, as expressed in the work of the Bauhaus founders, on Hajjar's architectural language. This influence is demonstrated through a comparison of the grammar developed for Hajjar's single-family architecture [5] with the grammar developed for the Gropius-Breuer partnership in the United States. Future papers will focus on further methodological steps related to the notion of hybridity.

### 2.1 Shape Grammar

Defined as a set of rules of transformation applied recursively to an initial form in order to generate new forms, shape grammar formalism was introduced by Stiny and Gips in 1972 and further developed by Stiny [7] and Knight [8]. In other words, a shape grammar is a rule-based system for analyzing, describing, and generating visual or spatial designs. Shape grammars began as a concept, with early applications focused on fine arts [9], decorative arts [10, 11], architecture [12, 13] and eventually on design [14, 15], including urban design [16, 17]. Given that the work of the present study's focal architect shows some evidence of shapes and transformation rules shared with the work of other architects in a distinctly different style, the shape grammar methodology is appropriate for testing the hypothesis.

An important question regarding comparing shape grammars pertains to how detailed they need to be. This question can be answered in the process of developing grammars by finding where hybridity exists, whether in the functional organization (layout), building systems, and/or decoration. The next step would be to determine the extent to which the rules of the respective grammars are similar or different. By comparing the shape rules of Hajjar's grammar to those of the Gropius-Breuer grammar, we may be able to determine rules that have been adapted, deleted, changed, and created (added), which may, in turn, explain similarities and differences between the two architectural languages.

## 2.2 Related Work

The current study, and the larger research project, follow in the footsteps of research studies published by several authors. In 1983, taking the transformation of Frank Lloyd Wright's Prairies houses into Usonian houses as one of her focal cases, Knight showed how stylistic evolution in art and design can be explained by the evolution of the underlying grammars. In 2005, Çolakoğlu used this idea to propose a methodology to design contemporary houses based on vernacular Turkish Hayat houses. Using the idea of grammatical transformation, Chase and Ahmad [19] described hybridity in design. Then, in 2011, Eloy and Duarte proposed the concept of transformation grammar to adapt existing house types to the needs of contemporary life. In the same year, Kruger et al. [21] advocated the use of transformation grammar to study Alberti's influence on classical Portuguese architecture, and more recently Benrós [22] used transformations in design to study the phenomenon of hybridity in architectural languages. Against this background, the present paper is principally concerned with using shape grammars to describe the influence of Bauhaus internationalism—brought to the US by Gropius and Breuer—on Hajjar's single-family architecture.

## 3 A. William Hajjar

Abraham William Hajjar (1917–2000), the youngest of a large immigrant Lebanese family, was born on February 11, 1917, in Lawrence, MA. In 1936, he left the family's grocery store business to study architecture at the Carnegie Institute of Technology (now Carnegie Mellon). He received his professional Bachelor of Architecture degree in 1940. A year later, he received a master's degree from MIT. After teaching for a few years at the State College of Washington, he joined the Department of Architecture at the Pennsylvania State University in State College in 1946 [23]. He then focused on securing tenure for a number of years. However, from 1952 when he built his first design in the area to 1963 when he moved to Philadelphia on a leave of absence from Penn State to work with Vince King, a friend from MIT and a successful Philadelphian architect, Hajjar designed and built thirty-two single-family houses in the Penn State area (Fig. 1).

In the late 1930s, when Hajjar was at Carnegie, the school, like most of the architecture programs in the country, was dominated by the Beaux-Arts. However, he came into contact with some of the young faculty members teaching freshman and sophomore studios who favored a modernist design philosophy. In addition, and perhaps, critically, Walter Gropius, founder of the Bauhaus School and a pioneering master of modern architecture, delivered a lecture at Carnegie in 1938, when Hajjar was a sophomore. This was probably, the first interaction between Hajjar and Gropius.

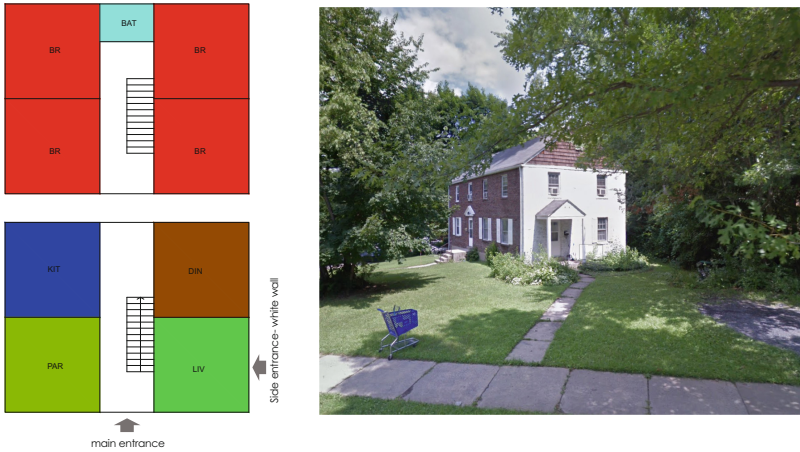
As explained in a previous paper [5], while at MIT, Hajjar became well-versed in modernism under the supervision of Lawrence Anderson. Anderson would have been an important influence given that he both designed the first modernist building on an American campus (MIT Alumni Pool-1939) and endeavored to bring a modern outlook

to MIT's program in the late 1930s. It is likely that Hajjar was influenced by modernist ideas propagated by the German émigrés: that is, he was at MIT when Gropius and Breuer were at Harvard and would have been included in the collaborations orchestrated by Anderson between the two schools referenced earlier [3]. Also, while Hajjar was at MIT, the architecture program collaborated with Harvard on a summer semester design project whereby a class from each institute, probably a small number of students, rented a house in the cape where they lived and worked on a project together. These collaborations between MIT and Harvard introduced not only Hajjar, but also his schoolmates, to Gropius's philosophy of architecture. Other well-known architects who were students at MIT under Anderson's supervision at the time include Gordon Bunshaft, George Nakashima, I.M. Pei, Bill Hartmann, Clarence Y. Yokomoto, and Vince Kling. During a leave of absence from Penn State in the mid-1960s, Hajjar worked as a senior designer at a large practice that Kling eventually established in Philadelphia.

### 3.1 Hajjar's Architecture

In 1946, when Hajjar first moved to State College with his family to teach at Penn State, he bought a traditional two-story Georgian revival house close to campus (Fig. 1). The house had a traditional four-square plan with an organization similar to Hajjar's own future designs, although that latter is rendered in a more modern way. To be different, and to make it easier for his family to recognize the house from other similar houses of the area, as he mentioned to his son, he painted the street face of the house white, a move that shows his philosophy of improving traditional American architecture by mixing it with modern ideas/elements. His first design in the area, a house for his own family, was built in 1951–1952. Hajjar's first family house represents his main idea of volumetric design and interior planning: the house consists of a simple shoebox, i.e., the main house, with a garage connected to it by a breezeway. At that time, most of the single-family houses in the area were in the Georgian revival, Colonial revival, Tudor, and Cape Cod styles, although ranch and split-level houses were also starting to appear. Hajjar designed and built thirty-two single-family houses in the area, many of which were very similar to his first family house in State College. As explained in a previous paper [5], many of his houses blend into the traditional houses in the neighborhood in terms of exterior building materials, volumes, and roof shapes. However, Hajjar's houses have an internal organizational structure that is both modern for the time and unique to his work.

In the plans, the entryway to Hajjar's houses on the main floor is through the breezeway and generally in the middle open space, which could include a hall and a family/sitting room on the private floor. Hajjar's typical plan can be read as a modern layout with an open space in the center, rooms organized on both sides, and the service spaces, including the bathroom, staircase, and hallway, in the middle. However, it can also be read as a very traditional plan as used in the Georgian period and the Georgian Revival, i.e., a developed hall-parlor organization, or as a developed foursquare design, similar to the plan of the first house Hajjar bought in the area.



**Fig. 1.** Hajjar's first house in the area and its schematic layout.

As explained in a previous paper [5], the houses Hajjar designed for the area can be grouped according to five subtypes based on the volumetric relationship and spatial organization: (1) tri-partite organization, where a breezeway connects the garage to the inhabitable space, the lower floor hosts the living areas, and the upper floor the sleeping area; (2) split-level organization, where the sleeping area is a half floor above the living area; (3) butterfly, where a cross-shape or U-shape organization prevails; (4) compact organization, where a square-shaped plan reflects Hajjar's idea of a core area; and (5) linear organization, where two square-shaped plans forms a rectangular/linear plan.

A comparison between Hajjar's plans with both traditional houses in the area and modern houses designed by pioneers of modern architecture, such as Gropius and Breuer, reveals their likely influence on his architectural production. This architectural observation will be scientifically tested by comparing Hajjar's grammar with that of the Gropius-Breuer partnership.

### 3.2 Hajjar's Grammar

A detailed account of the development of the grammar for Hajjar's work is available in a previous paper by the authors [5]. In general, the grammar of Hajjar's single-family houses was developed based on the five subtypes described in the previous section. The grammar encompasses four phases or groups of rules:

- (1) Rules that capture the way in which Hajjar situated his houses on the lot (Rules 1–2);
- (2) Rules that describe the formal relationships between mass volumes (Rules 3–5);
- (3) Rules that describe the way in which the interior space is divided into smaller rooms or spaces (Rules 6–29); and
- (4) Rules that generate details such as the placement of closets and wall thickness (Rules 36–39).

The grammar can both produce all the houses designed by Hajjar in the area and generate new designs based on Hajjar's architectural language (Fig. 2).

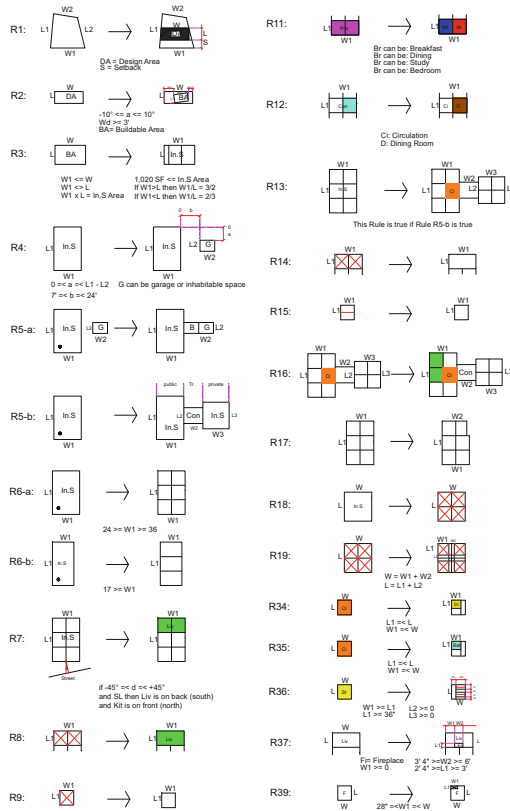


Fig. 2. Selected rules of Hajjar’s grammar.

## 4 Walter Gropius and the Bauhaus Culture

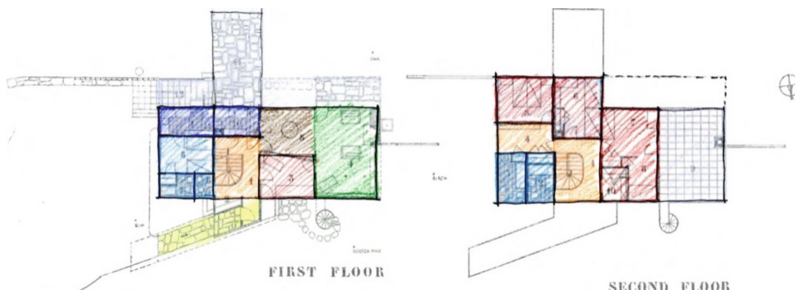
Finding solutions to the problems experienced by the working classes after World War I in Germany was fundamental to the Bauhaus school of design, a group of architects and artists led by Walter Gropius that formally came into existence in 1919, in Weimar, Germany. Their core concept was to reimagine the material world in order to express unity among all the arts. Gropius described this concept of unifying arts and design in the Proclamation of the Bauhaus (1919), in which the Bauhaus was described as a craft organization combining architecture, sculpture, and painting into a unified creative expression [24]. However, because of the rise of political dictatorship in Europe and its detrimental effects on German culture, Gropius resigned from the Bauhaus in 1928, followed by Breuer, Moholy-Nagy, Bayer, and Schawinsky. When Hitler closed the Bauhaus in 1933, most its members left Germany to take teaching positions abroad. By the time World War II broke out, most were teaching at major schools in the United States, where they were to influence an entire generation of American artists and architects. Therefore, the first point that comes to mind in regard

to European influence on American architectural culture in the modern era is the direct legacy of the Bauhaus—not its continuation, but its postscript.

Among the members of the Bauhaus who played an important role in American architecture as faculty members were Walter Gropius, Ludwig Mies van der Rohe, and Marcel Breuer. Their contributions were supported by the efforts of three other Bauhaus teachers: Herbert Bayer (graphic designer), and especially Josef Albers and Laszlo Moholy Nagy [25]. Other leaders of modern architecture who had been part of the Bauhaus also immigrated to the United States and also contributed to the modern movement in the country. However, as William Jordy argues, in no sense did their influence on American architecture match that of Gropius, Mies, or Breuer [25].

Having determined that the U.S. offered a receptive environment for their work and views, the German immigrants arrived in the country in the late 1930s. As noted earlier, Harvard's GSD was the first school in the nation to officially train students in modernist architecture with the appointment of Gropius as the Director of the Department of Architecture in 1937. Soon, Marcel Breuer joined Gropius in the U.S., not only to teach with him at Harvard but also to form a brief architectural partnership. It is worth adding here that the teaching of Gropius and Breuer at Harvard and van der Rohe at IIT marked '*the beginning of systematic training in modern principles in American architectural education*' (see p. 486 in [26]).

In Germany, Gropius had focused on large-scale buildings, such as apartment buildings and institutional projects. The only residential house that he designed in Germany was "Master's House," a group of combined single-family houses for the Bauhaus masters, commissioned by the City of Dessau in 1925–1926. He started designing single-family architecture when he immigrated to the United States. He (with Breuer) designed his first house, Gropius House, for his own family in Lincoln, MA, in 1937 with the construction ending in 1938 (Fig. 3). Modest in scale in comparison to other houses in the area, Gropius House was revolutionary in terms of its impact. The house incorporates traditional elements of New England architecture, such as wood, brick, and local stones, combined with modern materials, such as glass block, acoustical plaster, and chrome banisters. A National Historic Landmark, Gropius House is the posterchild for localized Bauhausian architecture in the New England area and in the United States more generally.



**Fig. 3.** Spatial relationship in Gropius House. Color representation: green represents the living room, light red represents bedrooms, blue represents service space, and orange represents transitional space/corridors. (Color figure online)



Many of the features of Gropius House can be seen in Hajjar’s designs in State College. For example, many of Hajjar’s houses combine minimal, simple, and modest modern design with local materials; have large panes of glass to obtain a picturesque view of the landscape; and include a screened porch as an American architectural element. Also, Hajjar’s use of a rectangular pattern/grid and the dividing elements of his interior plans are to some extent similar to the interior plan of Gropius House. Further, these similarities become more pronounced following the period Breuer spent studying binuclear organization for American houses: In 1943, Breuer was studying his idea of using a two-part organization for residential houses. The Geller House in Lawrence, NY is one of the first houses that employs Breuer’s idea of a binuclear house, with two wings/parts for day-time activities and night-time activities separated by an entry hall. Most of the houses designed by Breuer/Gropius from this point onwards, including Robinson House (1946), Alworth House (1954–1955), and Hooper House (1956–1959), have a similar organization. Many of the houses that Hajjar designed in the 1950s also have a two-part organization in the same style.

### 4.1 Gropius-Breuer Grammar

The grammar for the work of Gropius and Breuer in the United States was developed with the same strategy as that used for the grammar of Hajjar’s work. Generally, to compare grammars with each other, they should be developed in the same way at the same level of detail. When this is the case, it is easiest to compare the grammars by determining which rules are adapted, deleted, changed, or added (created).

Figures 4, 5, 6 and 7 show selected rules of the grammar developed for Gropius and Breuer’s work in the United States. The grammar can produce both early houses that the architects designed in style that closely resembles the Bauhaus and the binuclear plans. Figure 8 shows a step-by-step derivation of Gropius and Breuer’s Robinson House, which was used to infer the grammar. In addition to all the houses designed by Gropius and Breuer in the United States, the grammar can generate additional plans in the architectural language of the Gropius-Breuer partnership.

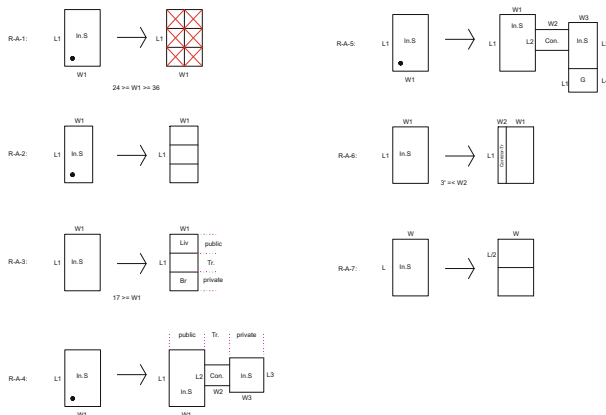


Fig. 4. Selected rules of Gropius-Breuer’s grammar: define relationship between volumes

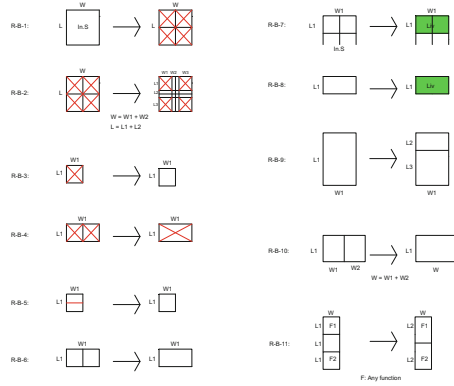


Fig. 5. Selected rules of Gropius-Breuer's grammar: divide interior space into smaller space

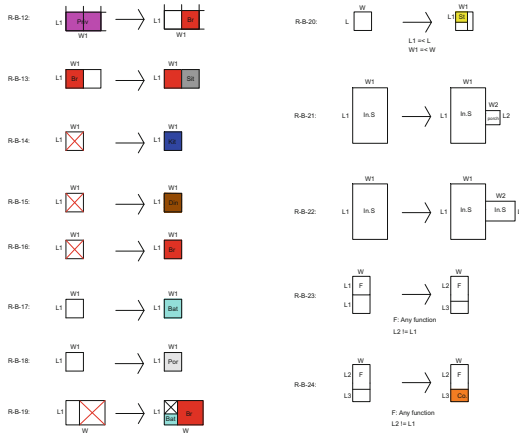


Fig. 6. Selected rules of Gropius-Breuer's grammar: assigning functions to interior space

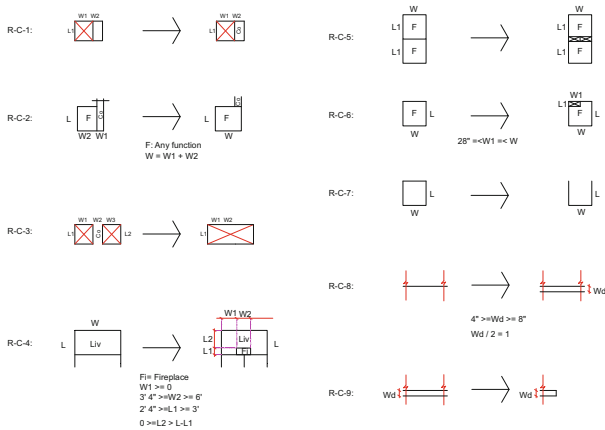


Fig. 7. Selected rules of Gropius-Breuer's grammar: interior detailing

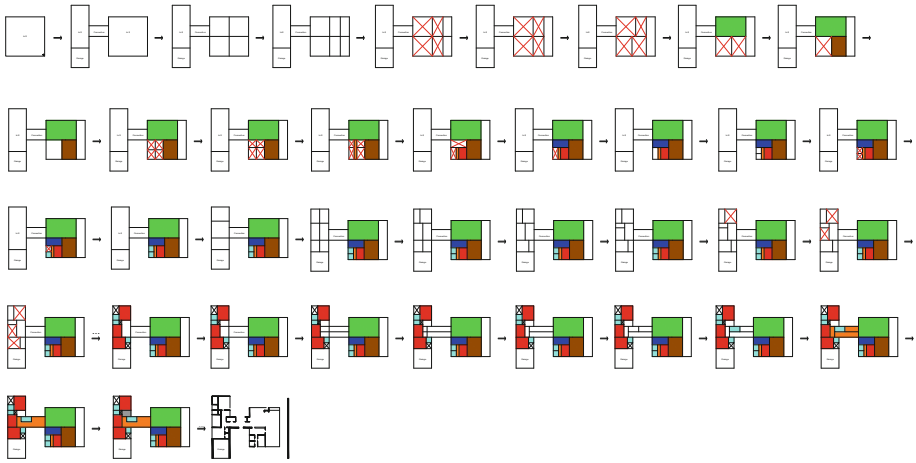


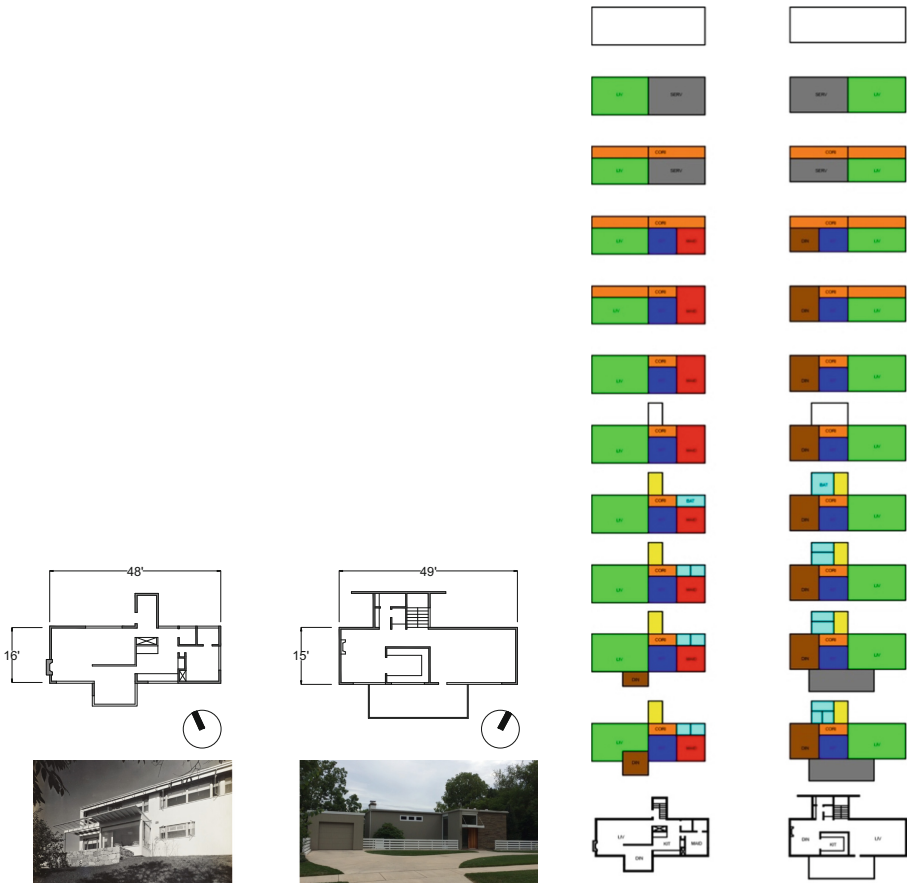
Fig. 8. Derivation of the Robinson House designed by Gropius-Breuer in 1946

## 5 Grammar Comparison

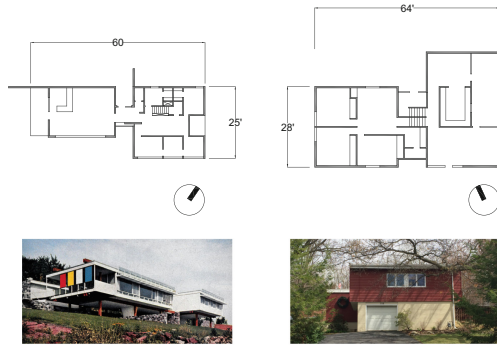
As noted earlier, using shape grammars, the authors focused on comparing Hajjar’s architecture in State College with single-family houses designed by the Gropius-Breuer partnership in the United States. In order to do this, the rules of the two grammars should be compared and contrasted. There are two ways to test similarities between the rules of the two grammars: (1) compare step by step the derivation of a house designed by the Gropius-Breuer partnership and the derivation of a house by Hajjar, and (2) produce a Gropius-Breuer house through the grammar of Hajjar’s work and compare it with the original design.

Figure 9 shows a comparison of a step-by-step derivation of the James Ford House designed by the Gropius-Breuer partnership in 1939 and the Higdon Residence designed by Hajjar in 1955. Higdon House is one of the few houses designed by Hajjar with a linear organization and a division between daytime and nighttime activities such that each is assigned to its own floor. It is also possible to produce the James Ford House using the Hajjar grammar. Although the part that projects out to expand the dining area is unique to the Gropius-Breuer design. The same strategy is demonstrated in Fig. 11, which shows a comparison between Alworth House designed by the Gropius-Breuer partnership and built in 1954 and the Eakin Residence designed by Hajjar and built in 1955 (Fig. 10). It is important to note that with this comparison, the authors do not suggest that Hajjar’s Eakin House is directly influenced by Gropius-Breuer’s Alworth House. Instead, Hajjar’s architectural language in general was influenced in some ways by European modernism through the work of Gropius and Breuer. The grammar comparison reveals similarities in interior planning, spatial organization, separation of day-time and night-time activities, and geometry and volumetric organization between the respective architectural languages of Hajjar and Gropius-Breuer.

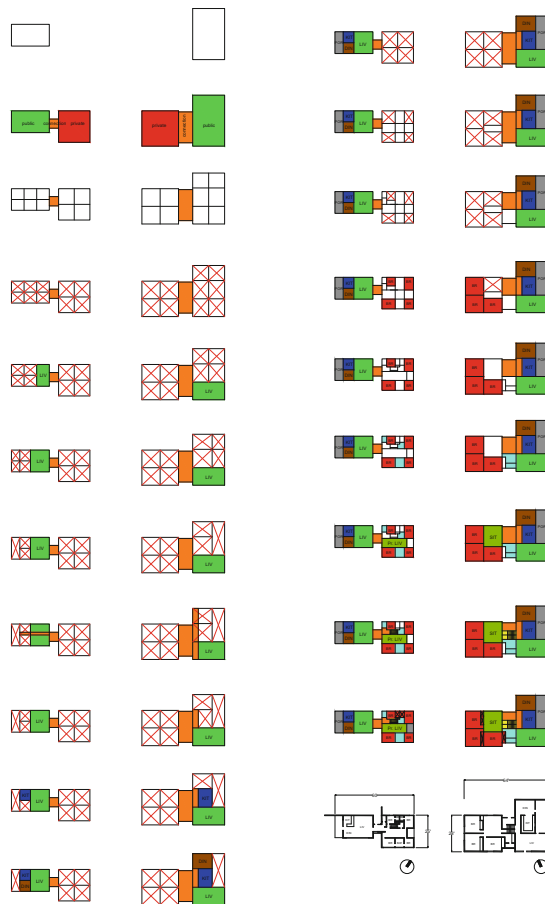
It is worth noting that many of Hajjar’s design decisions may reflect an influence that is cultural and/or contextual in nature rather than a formal influence from modernism or traditional architecture. For example, placing the living room at the back of the house facing the backyard and having the kitchen face the street were common organizational features of mid-twentieth-century houses in the United States. Other decisions would have been based on the availability of materials or building technology, i.e., the width/length of the open living room was dictated by the structural system.



**Fig. 9.** Comparison of a step-by-step derivation of the James Ford House designed by Gropius-Breuer (left) and the Higdon Residence designed by Hajjar (right).



**Fig. 10.** Alworth House designed by Breuer-Gropius in 1954 (left) and the Eakin Residence designed by Hajjar in 1955 (right).



**Fig. 11.** Comparison of a step-by-step derivation of the Alworth House designed by Gropius-Breuer (left) and the Eakin Residence designed by Hajjar (right), organized in two columns.

## 6 Discussion

As noted earlier, this paper is part of a larger study undertaken with the purpose of analyzing Hajjar's hybrid single-family architecture by developing a grammar of his work and comparing and contrasting its shape rules with those of works of modernist and traditional American architecture. The purpose of the present paper, however, is to test the effectiveness of shape grammar as a computational design methodology in comparing architectural languages and analyzing hybridity in architectural design. Comparing the grammar of Hajjar's work with the grammar of the Gropius-Breuer partnership's work in the United States demonstrates that shape grammar as a computational design methodology can be an effective way for architectural historians to verify and describe such influences and, therefore, for identifying hybridity in architectural design.

In relation to Hajjar's architecture in the State College area, this study highlights his contributions to the stability and popularity of modern architecture in the United States and his roles as a teacher and practitioner who followed in the steps of Gropius and Breuer in localizing/Americanizing Bauhaus culture in the United States.

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