A SHAPE GRAMMAR FOR HYBRIDITY:
THE DOMESTIC ARCHITECTURE OF WILLIAM HAJJAR
IN STATE COLLEGE, PENNSYLVANIA

A Dissertation in
Architecture

by
Mahyar Hadighi

© 2020 Mahyar Hadighi

Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Doctor of Philosophy

August 2020
The dissertation of Mahyar Hadighi was reviewed and approved by the following:

Jose Pinto Duarte  
Professor of Architecture  
Dissertation Co-Advisor

Ali Memari  
Professor of Civil and Environmental Engineering  
Dissertation Co-Advisor  
Chair of Committee

James Cooper  
Associate Professor of Architecture

Loukas Kalisperis  
Professor of Architecture

Anne A. Verplanck  
Associate Professor of American Studies

Rebecca Henn  
Associate Professor of Architecture  
Director of Graduate Studies
ABSTRACT

The purpose of this study is to analyze William Hajjar’s single-family houses in State College, Pennsylvania, home of the Pennsylvania State University’s main campus, by using shape grammar as a computational design methodology. Shape grammar is used to verify and describe the influence of European modern architecture and American traditional architecture on Hajjar’s domestic work. The analysis provides a foundation for developing a systematic methodology to analyze hybridity in architectural design. Hajjar, a member of the architecture faculty at the Pennsylvania State University (the Pennsylvania State College at the time) and a practitioner in State College, was an influential figure in the history of architecture in the area.

In order to compare Hajjar’s domestic architecture with European modern and American traditional architecture, this study follows three intertwined pathways: (1) Hajjar’s life and practice are traced to identify likely influences on his work. (2) A shape grammar is developed for the houses he designed in State College. Further, shape grammars for some of the architecture likely to have influenced his architectural production are developed, specifically a grammar for the domestic architecture of Walter Gropius and/or Marcel Breuer in the United States and a grammar for traditional houses in the context in which Hajjar’s work evolved. Hajjar’s grammar is compared to and contrasted with the grammars of these works to identify similar rules among them and to thereby determine the nature and extent of these possible influences. (3) Aspects of the social and technological context that may explain these influences—i.e., trends in regard to lifestyle and available technology—are identified.

The theoretical outcomes of this study answer these central questions in regard to the methodology and context: Can shape grammars be used to verify and describe the possible
hybridity between modern and traditional architecture in Hajjar’s work? More broadly, can shape grammars be used to describe an architectural hybridity phenomenon in general?
TABLE OF CONTENTS

LIST OF FIGURES ........................................................................................................... viii

LIST OF TABLES .............................................................................................................. xvi

ACKNOWLEDGEMENTS ................................................................................................. xvii

Chapter 1  Introduction .................................................................................................... 1

  American Modernism ................................................................................................. 4
  Vision ............................................................................................................................. 6
  The Notion of Hybridity ............................................................................................... 8
  William Hajjar ............................................................................................................. 9
  Shape Grammar ......................................................................................................... 10
  Research Questions ..................................................................................................... 11
  Methodology .............................................................................................................. 12
    Objectives ................................................................................................................ 12
    Hypothesis .............................................................................................................. 13
    Data Collection ....................................................................................................... 14
    Steps ........................................................................................................................ 16
  Contribution to Knowledge ......................................................................................... 17
  Dissertation Structure ............................................................................................... 18

Chapter 2  Background .................................................................................................... 20

  Modern Architecture .................................................................................................. 20
    The Beginning ......................................................................................................... 20
    Post-war United States ............................................................................................ 26
    Schools of Modern Architecture ............................................................................ 29
    The College Town: An American Phenomenon ...................................................... 31
    Architectural Pedagogy in the United States .......................................................... 34
    The Bauhaus Legacy ............................................................................................... 38
  Houses in the United States in the Mid-Twentieth Century ....................................... 39
    Usonian Houses ...................................................................................................... 40
    Post–World War II ................................................................................................... 41
    The American Dream and Post–World War Housing .............................................. 45
  Shape Grammar ......................................................................................................... 55
    Analytical Shape Grammar ................................................................................... 58

Chapter 3  Adapting Modern Architecture to a Local Context: A Grammar for Hajjar’s
  Hybrid Domestic Architecture ..................................................................................... 67

  Introduction ................................................................................................................ 67
  Preliminary Work ........................................................................................................ 68
  Adaptations of Modern Architecture ......................................................................... 70
# Bibliography

Chapter 4  Bauhaus Internationalism to College Town Modernism: Exploring Bauhaus Culture in Hajjar’s Hybrid Architecture ................................................. 106

Introduction ........................................................................ 106
Walter Gropius and the Bauhaus Culture ................................ 108
  Early Life and Training ..................................................... 108
  The Bauhaus ................................................................... 111
  Gropius and the Bauhaus Legacy in the United States .......... 112
  Gropius–Breuer Grammar ................................................... 114
Grammer Comparison .......................................................... 123
Discussion ........................................................................ 132

Chapter 5  Using Grammars to Understand Localized Modernism: The Case of William Hajjar’s Single-Family Houses in State College, PA ............ 135

Introduction ......................................................................... 135
The College Town: An American Phenomenon ...................... 137
  Traditional American Architecture in State College, PA .... 137
  Grammar for American Traditional Houses in State College 140
Grammer Comparison ........................................................... 148
Discussion ......................................................................... 157

Chapter 6  Tracing Hybridity in Local Adaptation of Modern Architecture: Comparing Hajjar’s Architectural Language with European Modern Architecture and American Traditional Architecture ........................................... 159

Introduction ......................................................................... 159
Shape Grammar .................................................................... 160
  Comparison and Discussion of the Grammars Developed .... 164

Chapter 7  Conclusion ................................................................ 179

Summary ............................................................................. 179
Contributions ........................................................................ 181
  Major Contributions/Findings ......................................... 182
  Minor Contributions/Findings ......................................... 184
Future Work ......................................................................... 185
  Improvements .................................................................. 185
  Major steps ...................................................................... 187

Bibliography ......................................................................... 189
Appendix A ..................................................................................................................
  Faculty-Practitioners in College Towns with Architecture Degree Programs in the
  Mid-Twentieth Century .............................................................................................. 203

Appendix B Single-Family Houses Designed by William Hajjar in State College, PA in
  the Mid-Twentieth Century ...................................................................................... 209
LIST OF FIGURES

Figure 2-1: Bubble chart of the application domain of the shape grammar method. Image from S. Garcia (2016). ................................................................. 56

Figure 2-2: Example of a shape grammar and the computation of a rule. ....................... 56

Figure 2-3: Robie House designed by Frank Lloyd Wright and three new designs generated by the shape grammar. Note that Stiny House, March House, and Little House were not designed by Frank Lloyd Wright. Instead, they were generated by the shape grammar based on Wright’s Prairie Houses. Image from Koning and Elizenberg (1981). ............................................................................. 60

Figure 2-4: Vantongerloo’s paintings representing six of the seven groups of his paintings. Image from Knight (1989). ............................................................. 61

Figure 2-5: A derivation of a design in the language generated by the stage I grammar created by Knight (1989). ................................................................. 62

Figure 2-6: Basic composition rules used by Knight (1994) to transform the Prairie House grammar into the Usonian House grammar. ........................................... 63

Figure 2-7: Algorithm of rule derivations in “Digital Alberti” as expressed in Portuguese Renaissance architecture (Bruno et al., 2014). ........................................ 65

Figure 3-1: A data collection form completed for a Hajjar design in State College, Pennsylvania. ........................................................................................................ 72

Figure 3-2: Diagram (produced by author) of Hajjar’s Hansen House in State College, Pennsylvania, 1956. .................................................................................. 73

Figure 3-3: Diagram (produced by author) of Marcel Breuer’s House in the Museum Garden, MoMA exhibition of 1949. ..................................................................... 73

Figure 3-4: William Hajjar (top right) with his seven siblings at a family reunion near Boston in 1956. Image from the Hajjar family collection. ......................... 74

Figure 3-5: MIT Alumni Pool (1939) designed by Lawrence Anderson and Herbert Beckwith. Image from The Filtration System for the New M.I.T. Swimming Pool. ....... 76

Figure 3-6: Hajjar’s first single-family house, which he lived in with his family in State College, Pennsylvania, at 1157 S. Atherton Street. .............................................. 78

Figure 3-7 (a&b): Hajjar House I, built in 1951 (left). A simple diagram of the house façade in its current situation. The blue lines show an addition built above the breezeway (right). 78
Figure 3-8: Diagram (produced by author) showing Hajjar’s first project in State College, Pennsylvania: the garage (gray) is connected through a breezeway (green) to the main house.

Figure 3-9: Hajjar and Wall Association office in State College, Pennsylvania, built in 1958.

Figure 3-10: Number of single-family residences designed by Hajjar in State College, Pennsylvania, while at Penn State.

Figure 3-11: Diagram of a Hajjar residential design with a core shoe box.

Figure 3-12: Diagram showing a Hajjar design with the main house connected to a garage through a breezeway.

Figure 3-13: Diagram of main house with two wings designed by Hajjar.

Figure 3-14: Reproduction of the front elevation of the Eakin Residence, designed by Hajjar and built in 1955 in State College, Pennsylvania.

Figure 3-15: Hajjar’s section drawing for the Eakin Residence in State College, Pennsylvania, constructed in 1955.

Figure 3-16: Reproduction of Robert Malcom’s diagram showing the room arrangement of Hajjar’s classic design.

Figure 3-17 (a, b, and c): Gunson Hall, Lorton, VA, example of a Georgian villa plan as it appeared in the early twentieth century, prior to restoration (left); a typical American four-square plan (catalogue house) (center); and the second floor of a developed four-square plan (right).

Figure 3-18: Diagrams of Hajjar’s classic house. Garage connected to the main house through the breezeway (left) and a second floor with four bedrooms (right).

Figure 3-19: Reproduction of Hajjar’s design for a “New Residence” on Cherry Hill Road, State College, Pennsylvania. From top left to bottom right: conceptual design, lower floor, main floor, and upper floor plans.

Figure 3-20: Hajjar’s rendering for the Gemmell Residence, State College, Pennsylvania, 1957.

Figure 3-21: Diagram (produced by author) showing the façade of the Gemmell Residence, State College, Pennsylvania, 1957.

Figure 3-22: Diagram (produced by author) showing subtypes of Hajjar’s plans: Subtype icon (left column), different subdivisions within the subtype (gray), and main functional organization of the subtype (colored). Color representation: bedroom.
(red), living area (green), dining room (brown), kitchen (dark blue), transitional space (orange), and bathroom (light blue). .................................................................91

Figure 3-23: Diagram (produced by author) showing the spatial relationship in the Isenberg Residence, designed by Hajjar. Note the relationship between the main volume (the inhabitable space), the garage (left), and the breezeway (yellow in the middle). In the main level of the inhabitable volume, the rectangular plan is divided into six rectangles. Functional spaces are divided by private and public functions. Color representation: living room (green), bedrooms (light red), service space (blue), transitional space (orange), and staircase (yellow). ........................................92

Figure 3-24: Diagrams (produced by author) showing the main living floors of four houses designed by Hajjar located on Glenn Road, State College, PA, as a development project (1955–1956). The houses were not built for specific clients; instead the land was purchased, and buildings were built and sold in partnership with a local developer.................................................................93

Figure 3-25: Diagrams (produced by author) showing the floor plan of the Held Residence, designed by Hajjar (1958), which has a split-level organization. Note that the main living area (which is divided into three parts) is dedicated to public functions whereas the spaces for private functions are located a half level higher up. Color representation: living room (green), dining room (brown), kitchen (purple), bathroom (blue), bedroom (red), circulation/hallway (orange), and staircase (yellow). ..................................................................................94

Figure 3-26: Diagrams (produced by author) showing the plans of the two main floors of the Herzog Residence (Osmond Street Project House #3). Note that the spatial organization reflects a square-shaped plan. Color representation: living room (green), kitchen (purple), bedroom (red), family sitting area (brown), bathroom (blue), circulation/hallway (orange), and staircase (yellow). .................................................................94

Figure 3-27: Spatial organization of houses designed by Hajjar in the State College, Pennsylvania, area: subtype A .................................................................95

Figure 3-28: Spatial organization of houses designed by Hajjar in the State College, Pennsylvania, area: subtypes B and C .................................................................95

Figure 3-29: Spatial organization of houses designed by Hajjar in the State College, Pennsylvania, area: subtypes B and C .................................................................96

Figure 3-30: Spatial organization of houses designed by Hajjar in the State College, Pennsylvania, area: subtypes D and E .................................................................96

Figure 3-31: Rules of the Hajjar grammar capturing how the houses are situated on the lots and the rules describing the formal relationship between the volumes .........................................................97
Figure 3-32: Rules of the Hajjar grammar describing the way in which the interior space is divided into smaller rooms/spaces and the allocations of functions. ................................. 98

Figure 3-33: Rules of the Hajjar grammar describing the way in which the interior space is divided into smaller rooms/spaces and the allocations of functions. ................................. 99

Figure 3-34: Rules of the Hajjar grammar describing the way in which the interior space is divided into smaller rooms/spaces and the allocations of functions. ................................. 100

Figure 3-35: Rules of the Hajjar grammar describing the details generated, such as wall thickness and the placement of closets. ................................................................. 100

Figure 3-36: Derivation of the Snowdon Residence, State College, Pennsylvania, designed by Hajjar in 1959. The rule numbers applied at each step are indicated above the arrow. ................................................................. 101

Figure 3-37: Derivation of the Eisenstein Residence, State College, Pennsylvania, designed by Hajjar in 1954 ....................................................................................................... 102

Figure 3-38: Derivation of a design (not designed by the architect) generated by the Hajjar grammar. .................................................................................................................... 102

Figure 3-39: From left to right: The Euwema Residence, Ferrell Residence, Christ-Janer Residence, and a Hajjar-inspired house, all generated by the computer program based on the Hajjar grammar. ........................................................................................................ 102

Figure 3-40: A variation tree of Hajjar’s houses based on subtypes A, B, and D. Note that the designs with a black rectangle around them are designs that Hajjar would never have designed; therefore, the grammar won’t generate them. ......................................................... 103

Figure 4-1: AEG Turbine Factory by Peter Behrens (1909). Image from Khan Academy. .... 109

Figure 4-2: The Fagus Factory in Alfeld-ander-Leine, Lower Saxony, Germany. Image from Wikipedia. .................................................................................................................... 110

Figure 4-3: Walter Gropius and Adolf Meyer, model factory (factory and office building), Werkbund exhibition, Cologne, 1914. Image from photobucket.com................................. 110

Figure 4-4: Masters’ Houses, a collection of seven houses designed for the Bauhaus professors close to the Bauhaus building in Dessau, Germany. Photograph by Lucia Moholy, 1926. .................................................................................................................... 113

Figure 4-5: Spatial relationship in Gropius House. Color representation: living room (green), bedrooms (light red), service space (blue), and transitional space/corridors (orange). .................................................................................................................... 113
Figure 4-6: Spatial analysis of Gropius House designed by the Gropius–Breuer partnership and built in 1938 in Lincoln, Massachusetts. ................................................................. 115

Figure 4-7: Spatial analysis of Hagerty House designed by the Gropius–Breuer partnership and built in 1938 in Cohasset, Massachusetts. ................................................................. 116

Figure 4-8: Rules of the Gropius–Breuer grammar: the relationship between volumes. ......... 117

Figure 4-9: Rules of the Gropius–Breuer grammar: the interior space is divided into smaller spaces. .................................................................................................................. 118

Figure 4-10: Rules of the Gropius–Breuer grammar: functions assigned to the interior spaces. .................................................................................................................. 119

Figure 4-11: Rules of the Gropius–Breuer grammar: interior detailing. ............................ 120

Figure 4-12: Derivation of Robinson House designed by Breuer and built in 1946. ............. 121

Figure 4-13: Derivation of Breuer House II designed by Breuer and built in 1947. ............. 121

Figure 4-14: Derivation of Starkey House, also known as Alworth House, designed by Breuer and built in 1954. .................................................................................................. 122

Figure 4-15: Derivation of a design generated by the grammar for Gropius and Breuer’s work. .................................................................................................................. 122

Figure 4-16: Comparison of selected rules of the grammars: the Hajjar grammar and the Gropius–Breuer grammar ......................................................................................... 124

Figure 4-17: Comparison of selected rules of the grammars: the Hajjar grammar and the Gropius–Breuer grammar ......................................................................................... 125

Figure 4-18: Comparison of selected rules of the grammars: the Hajjar grammar and the Gropius–Breuer grammar ......................................................................................... 126

Figure 4-19: Comparison of selected rules of the grammars: the Hajjar grammar and the Gropius–Breuer grammar ......................................................................................... 127

Figure 4-20: 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). Note that in each step, different rules may apply in each derivation. The steps with similar results are highlighted with a red border. ................................................................. 129

Figure 4-21: The Alworth House designed by Breuer and built in 1954 (left) and the Eakin Residence designed by Hajjar and built in 1955 (right). .................................................. 130

Figure 4-22: Comparison of a step-by-step derivation of the Alworth House designed by Breuer (left) and the Eakin Residence designed by Hajjar (right), organized in two
columns. Note that in each step, different rules may apply in each derivation. The steps with similar results are highlighted with a red border.

Figure 5-1: Examples of traditional houses in the College Heights Historic District, State College, Pennsylvania.

Figure 5-2: Main floors of a typical mail-order plan with a center hall colonial organization (left) and a four-square organization (right).

Figure 5-3: Conceptual diagram of the processes for developing and applying design systems, adapted from Duarte’s “Customizing Mass Housing.”

Figure 5-4: Diagram showing the concept of a generic grammar inferred from specific grammars and/or inferred from a corpus consisting of different corpora within the same design domain.

Figure 5-5: Rules to allocate staircase, bathroom, and halls adapted from the grammar for the Buffalo bungalows (Downing and Flemming, 1981).

Figure 5-6: Rules of the grammar developed for traditional houses, showing the location of the inhabitable space within the lot.

Figure 5-7: Rules of the grammar developed for traditional houses, showing the way in which the main inhabitable space can be divided into rooms.

Figure 5-8: Rules of the grammar developed for traditional houses, showing the allocation of interior spaces.

Figure 5-9: Rules of the grammar developed for traditional houses, showing the development of interior spaces and detailing.

Figure 5-10: Derivation of a traditional house based on the generic grammar for American traditional houses in the area.

Figure 5-11: Comparison of selected rules from the Hajjar grammar and the traditional grammar.

Figure 5-12: Comparison of selected rules from the Hajjar grammar and the traditional grammar.

Figure 5-13: Comparison of selected rules from the Hajjar grammar and the traditional grammar.

Figure 5-14: Comparison of selected rules from the Hajjar grammar and the traditional grammar.
Figure 5-15: Main floor of a four-square bungalow house in the College Heights District (left) and Hajjar’s Snowdon Residence (right). .......................................................... 153

Figure 5-16: Comparison of a step-by-step derivation of a four-square plan and Hajjar’s Snowdon Residence, both built in State College, Pennsylvania. The steps with similar results are highlighted with a red border.......................................................... 154

Figure 5-17: Derivation of a house with a layout as close as possible to Hajjar’s Snowdon Residence using the traditional grammar. .......................................................... 155

Figure 5-18: Hajjar’s Snowdon Residence (left) and a house with a similar layout generated by the traditional grammar (right). .......................................................... 156

Figure 6-1: Selected rules of the grammar developed for Hajjar’s work in State College, Pennsylvania....................................................................................................... 161

Figure 6-2: Selected rules of the grammar developed for Gropius and/or Breuer’s work in the US.......................................................... 162

Figure 6-3: Selected rules of the grammar developed for traditional houses. ................. 163

Figure 6-4: Comparison of the inhabitable space rules, the inhabitable space division rules, the garage space rules, and the private vs. public rules of the three grammars..... 165

Figure 6-5: Comparison of the binuclear organization rules and the interior space division rules of the three grammars ............................................................................. 166

Figure 6-6: Comparison of interior function allocation rules and the interior organization rules of the three grammars............................................................................. 167

Figure 6-7: Comparison of the interior organization–circulation rules, interior detailing (situating closet/fireplace) rules, and addition/porch/entry rules of the three grammars........................................................................................................... 168

Figure 6-8: Similarities between the three grammars in a diagram................................ 170

Figure 6-9: American traditional house built in 1928 in the College Heights Historic District in State College, Pennsylvania, which was used to derive the traditional grammar ........................................................................................................... 171

Figure 6-10: Derivation of a design generated by the Hajjar grammar similar to the interior plan of the house in Figure 6-9.......................................................... 171

Figure 6-11: Derivation of a house generated by the traditional grammar with a layout as close as possible to Hajjar’s Snowdon Residence............................................. 172
Figure 6-12: Hajjar’s Snowdon Residence (left) and a house of the same size with a similar layout generated by the traditional grammar (right). ............................................. 172

Figure 6-13: Original drawings of the Eakin Residence by Hajjar. .................................................. 175

Figure 6-14: A step-by-step derivation of a design as close as possible to Hajjar’s Eakin Residence, generated by the Gropius–Breuer grammar.......................................................... 175

Figure 6-15: Main floor plan of the Eakin Residence designed by Hajjar and generated by the Hajjar grammar (left), and the plan generated by the Gropius–Breuer grammar as close as possible to the layout of the Eakin Residence (right). ........................................... 177
LIST OF TABLES

Table 1-1: Elements of Modern Architecture in Various Definitions........................................2

Table 1-2: Main Shapes and Features of Traditional and Modern Architecture versus College Town Hybrid Architecture..................................................................................4

Table 1-3: Faculty-practitioners in Mid-twentieth-Century US College Towns Who Graduated from the “Less Conventional” Architecture Programs........................................7

Table 3-1: College Towns with Accredited Architecture Programs in 1940, Sorted by State, with Population and Enrollment Data from 2016 .................................................................69

Table 3-2: Registered Architects in the Borough of State College, Pennsylvania, in the Mid-twentieth Century .................................................................................................................77

Table 3-3: The First Five Single-Family Houses Designed by William Hajjar in State College, Pennsylvania. Note that North is up. .................................................................90

Table 5-1: Examples of Traditional American Houses Designated as Contributing to the College Heights Historic District in State College, Pennsylvania ........................................139
ACKNOWLEDGEMENTS

I am deeply thankful to my advisors—James Cooper, Jose Duarte, Loukas Kalisperis, Ali Memari, and Anne Verplanck—for their support and guidance. This dissertation owes much to Jose Duarte and Loukas Kalisperis not only for their guidance on the research associated with it, but also for their friendship and advice throughout my academic career at Penn State. They have taught me a lot, not only about the ways in which to pursue and bring a PhD dissertation to completion, but also about how to be an advisor. I cannot imagine having better advisors and mentors for my PhD study.

Tracking Hajjar’s life and practice would not have been possible without the unfailingly gracious assistance of Hajjar’s son, Mark, who provided considerable information about his family’s history and his father’s life and practice. I am also thankful for Mark’s generous donation of his father’s drawings to the Penn State Libraries to create the Hajjar Heritage Collection. My sincere thanks also go to Nicola McCarthy for her great editorial assistance.

I thank members of my cohort, the first PhD in Architecture cohort at Penn State, for their help and support throughout my studies.

Last but most of all, I would like to thank my family: my mother, who taught me to love learning, my brother for supporting me throughout this journey, and my beloved wife and daughter for their emotional support and patience every step of the way. I dedicate this dissertation to them.
Chapter 1

Introduction

The residential architecture of A. William Hajjar, a faculty member at Penn State and a practitioner in the mid-twentieth century, constitutes a hybridity between European modern architecture and traditional American architecture given that it incorporates many of the shapes, rules, and features of each style. In this study, this architectural phenomenon expressed through Hajjar’s work in State College, Pennsylvania, where Penn State’s University Park campus is situated, is considered in relation to both the modern architecture of the time and the traditional American architecture of the local context. The purpose of this study is to use a shape grammar–based computational design methodology to describe Hajjar’s single-family architectural language and verify the hybridity between modern architecture and traditional architecture evident in his work.

In *A Field Guide to American Houses*, Virginia and Lee McAlester describe “modern” as a post–World War II architecture that abandoned historical precedents in favor of new variations in architectural composition.¹ The modern US houses featured in their book are in general different from what we know as European modern architecture, defined earlier in the century by Henry-Russell Hitchcock and Philip Johnson. Hitchcock and Johnson defined modern architecture—primarily as the “International Style”—in reference to three identifying features: volume instead of mass, lack of ornamentation, and regularity and standardization of elements.²

Their definition was related to Le Corbusier’s five points for defining a new architecture. Rooted in Europe and transferred to and further developed in the United States, modern architecture, was characterized later in the twentieth century by scholars such as Kenneth Frampton, David Handlin, and William Curtis by principles close to those proposed by Hitchcock and Johnson (Table 1-1): a tendency to use simple rectangular volume (instead of mass) articulated by regularity, crisply cut openings, flat roofs, the avoidance of architectural decoration, an open floor plan, and a free façade design.

Table 1-1: Elements of Modern Architecture in Various Definitions

<table>
<thead>
<tr>
<th>Wrightian/Usonian</th>
<th>Le Corbusier’s five points</th>
<th>Hitchcock and Johnson’s modernism</th>
<th>Later definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typically small</td>
<td>Supports (pilotis)</td>
<td>Volume instead of mass</td>
<td>New technologies</td>
</tr>
<tr>
<td>No attic</td>
<td>Roof gardens</td>
<td>Lack of ornamentation</td>
<td>New materials</td>
</tr>
<tr>
<td>No basement</td>
<td>Free design of plan</td>
<td>Regular and standardized elements</td>
<td>(glass, steel,</td>
</tr>
<tr>
<td>Horizontal lines</td>
<td>Horizontal windows</td>
<td></td>
<td>reinforced</td>
</tr>
<tr>
<td>Walls of windows</td>
<td>Free design of façade</td>
<td></td>
<td>concrete)</td>
</tr>
<tr>
<td>Continuous interior spaces</td>
<td></td>
<td></td>
<td>Honesty in usage of materials</td>
</tr>
<tr>
<td>Indirect lighting</td>
<td></td>
<td></td>
<td>Ribbon windows</td>
</tr>
<tr>
<td>Bracket-mounted shelving</td>
<td></td>
<td></td>
<td>Flat roofs</td>
</tr>
<tr>
<td>Informality</td>
<td></td>
<td></td>
<td>Screen walls</td>
</tr>
<tr>
<td>Openness</td>
<td></td>
<td></td>
<td>Non-structural</td>
</tr>
<tr>
<td>Little or no ornamentation</td>
<td></td>
<td></td>
<td>partitions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Simple use of color and geometry</td>
</tr>
</tbody>
</table>

In pursuing the research for the present study, the author documented examples of mid-twentieth-century architecture in college towns across the US and found that many of them include multiple single-family houses designed by full-time faculty members holding positions with the NAAB-accredited architecture degree programs offered at the colleges situated there. Many of these houses, including those designed by William Hajjar in State College do not fully fit the existing mainstream categories of the period. That is, many are not built according to

---

3 Le Corbusier and Pierre Jeanneret, “Five Points Towards a New Architecture,” 1926, reprinted in Programs and Manifestos in Twentieth Century Architecture, by Ulrich Conrads (Cambridge: MIT Press, 1970). The five points established by Le Corbusier and Jeanneret are supports (pilotis), roof gardens, horizontal windows, the free design of the ground plan, and the free design of the façade.

4 Gwendolyn Wright, USA, Modern Architecture in History (London: Reaktion, 2008). G. Wright argues that although modernism is rooted in Europe, the notion that European émigrés brought modernism from Europe to the US “as if in a suitcase” and then taught it to other young American students is a myth.” Refer to Chapter 2, The Beginning.
popular mid-century ranch, split-level, shed, or minimal traditional styles. Nor do they feature the characteristics or shapes of modern architecture such as flat roofs, ribbon windows, and free façades, as first identified by Henry Russell Hitchcock and Philip Johnson (1932) and later by scholars such as Kenneth Frampton and William Curtis. Furthermore, these houses are not colonial, revival, or Victorian in appearance and, therefore, do not conform to traditional American styles. Instead, many of the houses simultaneously reflect traditional American styles together with forms associated with modernist ideologies: for example, some houses boast sloped roofs, partially open plans, large windows, a horizontal organization in a split-level arrangement, and traditional balloon frames with local stone, wood, or brick cladding (Table 1-2).

5 McAlester and McAlester, A Field Guide to American Houses.
6 In terms of recurrent motifs, modernism in architecture is characterized by “strip windows, flat roofs, grids of supports, cantilevered horizontal planes, metal railings and curved partitions” (Curtis, Modern Architecture, p. 257). The general qualities of the style are defined by features such as “the recurrent tendency to use simple rectangular volumes articulated by crisply cut openings, or to emphasize hovering planes and interpenetrating spaces” (Curtis, Modern Architecture, p. 257). In their book The International Style, Henry-Russell Hitchcock and Philip Johnson outlined the main visual principles of the new style with an emphasis on regularity, volume rather than mass, and the avoidance of architectural decoration. Along with the five points of architecture defined by Le Corbusier and Jeanneret, these are the central principles of modern architecture.
American Modernism

Unlike European modernism, which was based on internationalism and criticized for its placelessness, American modernism in the mid-twentieth century leaned toward regionalism. As

---

7 The shapes and features of traditional architecture and modern architecture are adapted from Devlin and Nasar (1989) cited in Lara (2008), and the shapes and features of college town hybrid architecture are based on the author’s observations.

8 Modernism in Europe was based more on internationalism.
Gwendolyn Wright notes, “American modernism remained strongly regional throughout the 1930s.” She argues that in the United States it was not only Frank Lloyd Wright and other American modernists who were advocating for regional modernism. In her view, architects who had emigrated from Europe, such as Walter Gropius and Marcel Breuer, were also applying the principles of modernism to American regionalism to some extent. In line with G. Wright’s view that residential modern architecture in the United States evinced a regional approach, it can be argued that these mid-century single-family houses designed by Hajjar as well as other houses built in other college towns could reasonably be referred to as instances of American modernism or contemporary style. However, there is no defined style known as “American modernism.” Moreover, conceptually and stylistically, as well as in terms of interior planning and construction materials and methods, these houses differ from the architecture of American modernists such as Frank Lloyd Wright. There are characteristics in common, but also differences. Given these differences, it is difficult to refer to these houses as either American modernism or Wrightian architecture. Instead, such houses can be categorized under the broad definition of a contemporary architecture that largely shaped “the burgeoning suburban landscape of mid-twentieth-century America.” In this regard, the hypothesis explored in this study is that the mid-century single-family houses designed by Hajjar and built in State College share characteristics with European modern architecture as defined by Hitchcock and Johnson and with both American modernism and Wrightian architecture.

---

9 Wright, USA, 127.
10 Wright, USA. The ways in which Gropius and Breuer applied modernist principles to American regionalism will be explained in detail in the Background section (Chapter 2). While at Harvard, the architects designed a house for Gropius, i.e., the Gropius House, using elements of the Bauhaus architecture, but also incorporating local clapboard and fieldstone and a screened porch.
12 This statement is actually part of the hypothesis. As a professional architect, the author understands that college town single-family houses share some characteristics with Wrightian architecture, especially with Wright’s Usonian Houses, i.e., a low-pitched roof, built-in furniture, the significance of the fireplace in the interior design, and the notion of horizontality. At the same time, many of these houses differ from Usonian Houses in significant ways, i.e., in interior planning, fenestrations, and spatial organization. The college town houses are designed with attached garages and basements and other characteristics that distinguish them from Wright’s Usonian architecture.
13 McAlester and McAlester, A Field Guide to American Houses, 475.
traditional architecture, including pre-WWII residential architecture (revival, Victorian, colonial revival, and eclectic houses) and popular mid-twentieth-century houses in the US (ranch and split-level houses).

**Vision**

In this research, Hajjar’s domestic architecture will be thoroughly analyzed in order to verify and explain the hybridity between traditional American and European modern architecture in his work. The influence of local, regional, national, and international architecture on Hajjar’s architecture will be demonstrated and analyzed. However, the ultimate goal, although it is beyond the scope of this study, is to use this analysis and comparison as a foundation for considering types and styles of architecture across all eras. Two possible avenues in this regard are (1) to consider the architecture of the past to show that architecture evolves through a hybridization process, and (2) to imagine an architecture of the future by applying a process of hybridization to generate new architectural styles appropriate to a given context.

Further, although beyond the scope of this research, it is also possible to explore a trend that reflects the same hybridity of modern and traditional architecture in the work of other architects of the time who received training according to modern architectural principles, held a position in an architecture degree program and practiced locally in their respective college towns. Numerous faculty members practiced architecture locally in the mid-twentieth century. However, based on the preliminary research conducted for the present study, only six of these had both trained according to modern architectural principles in the late 1930s and early 1940s, either directly or indirectly, with one of the European modern architect émigrés and practiced during the mid-twentieth-century post–WWII period in their respective college towns: Harry Merritt, Edward Olencki, William Hajjar, William Caudil, Leonard Currie, and Charles Burchard. These six
architects practiced in only five towns: State College, PA; Ann Arbor, MI; Blacksburg, VA; Gainesville, FL; and College Station, TX (Table 1-3). It is important to note that all six of these faculty members graduated from one of the “less conventional” architecture programs of the mid-twentieth-century United States, contexts in which students were exposed to modern architectural pedagogy, including Harvard’s Graduate School of Design (GSD), Black Mountain College, Taliesin, the Armour Institute (later the Illinois Institute of Technology (IIT)), the Institute of Design in Chicago (later part of IIT), the Massachusetts Institute of Technology (MIT), and the Georgia Institute of Technology.\footnote{Anthony Alofsin, \textit{The Struggle for Modernism: Architecture, Landscape Architecture, and City Planning at Harvard} (New York and London: W. W. Norton & Company, 2002); and Anthony Alofsin, “American Modernism’s Challenge to the Beaux-Arts,” in \textit{Architecture Schools, Three Centuries of Educating Architects in North America}, ed. Joan Ockman (Cambridge and London: MIT Press, 2012), 90–119.}

Table 1-3: Faculty-practitioners in Mid-twentieth-Century US College Towns Who Graduated from the “Less Conventional” Architecture Programs

<table>
<thead>
<tr>
<th>College town</th>
<th>University</th>
<th>Faculty-practitioner</th>
<th>Schools from which they received a degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gainesville, FL</td>
<td>University of Florida</td>
<td>Harry Merritt</td>
<td>Harvard</td>
</tr>
<tr>
<td>Ann Arbor, MI</td>
<td>University of Michigan</td>
<td>Edward Olencki</td>
<td>IIT</td>
</tr>
<tr>
<td>State College, PA</td>
<td>Penn State University</td>
<td>William Hajjar</td>
<td>MIT</td>
</tr>
<tr>
<td>College Station, TX</td>
<td>Texas A&amp;M</td>
<td>William W. Caudill (CRS)</td>
<td>MIT</td>
</tr>
<tr>
<td>Blacksburg, VA</td>
<td>Virginia Tech</td>
<td>Leonard Currie</td>
<td>Harvard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Charles Burchard</td>
<td>MIT and Harvard</td>
</tr>
</tbody>
</table>

Although these six faculty-practitioners are not nationally known as influential figures in the context of mid-twentieth-century architecture, each had an impact on the architectural taste of local people in terms of their acceptance of modern/hybrid architecture. Therefore, it can be argued that they were influential in popularizing modern architecture in the United States during the mid-twentieth century. Pursuit of this argument, however, is outside the scope of this research; instead, a separate study is needed to develop it.
The Notion of Hybridity

This notion of hybridity between modern architecture and traditional architecture, or the duality between modern and traditional, international and local, and designed and vernacular in architectural practice has already been addressed in the literature. Ideas such as “high-style” versus “popular” architecture in the mid-twentieth century, “Brazilian popular modernism,” “critical regionalism,” and “vernacular modernism,” and the contrast between vernacular traditions and the twentieth-century built environment all refer to this duality in various geographic locations and time periods. Also, the idea of mixing elements of European modernism with traditional American elements in architectural practice is in evidence earlier in the twentieth century, although not in regard to domestic architecture. As scholars such as Leland Roth note, most skyscrapers built in the 1920s combined selected elements of the International Style with the traditional revival styles such as Renaissance and Gothic typologies. In mid-twentieth-century US college towns, a key question on this point pertains to whether this hybridity can be verified and described, and if yes, whether shape grammars as a computational design method can be used to verify and describe hybridity. With further development of this computational description of hybridity, as noted above, issues related to the past and future of stylistic hybridity may be resolved.

---

15 Critical regionalism calls for architects to use elements from local and vernacular architecture (Frampton, 1983), whereas vernacular modernism calls for elements of high modern architecture to be incorporated into local vernacular architecture. However, Hajjar’s architecture, or college town architecture, in general, constitutes a mixture of both of these, thereby constituting one way to bridge modernist and popular architecture.


This study focuses on the architectural language of William Hajjar (1917–2000) in State College, home of the Pennsylvania State University’s University Park campus. From the work of the six faculty-practitioners included in Table 1-3, Hajjar’s single-family architecture in State College was chosen as the focal production of a faculty member for the present study for two principal reasons: (1) because of the easy access to his work around the Penn State campus and (2) because Hajjar designed and built thirty-three single-family houses in the area, more than any of the other five faculty members. It is fair to state that Hajjar’s role in the local history of architecture is significant.

Hajjar studied architecture at the Carnegie Institute (now Carnegie Mellon) (1936–1940) and MIT (1940–1941). Then, after teaching for a few years at Washington State College (now Washington State University), he became a faculty member at the Pennsylvania State College (now the Pennsylvania State University or simply Penn State) (1946–1963) and a practitioner in the area (1952–1963). The forms, shapes, and architectural language of the single-family houses he designed in State College will be analyzed in the context of both modernism and traditional architecture.

In this study, the architectural language of Hajjar’s single-family houses is defined as a step toward understanding stylistic hybridity through the use of computational methodologies. Shape grammars are used to demonstrate the underlying geometrical principles of Hajjar’s single-family houses, thereby providing a basis for considering his architecture in relation to that of other faculty and non-faculty practitioners of the time in relation to both modernism and
traditional American architecture.\(^{17}\) Shape grammars also establish a foundation for demonstrating Hajjar’s influence on the work of other architects.

**Shape Grammar**

Shape grammars in computation are a specific class of production systems based on an initial shape, or a set of finite shapes, and transformational shape rules.\(^{18}\) Since the 1970s, as a computational design theory, the concept of shape grammar has been used in architectural analysis when a pattern of design characteristics or a stylistic repetition of shapes in architecture is evident. This theory has been used to analyze examples of historical architecture, such as the Palladian villas as analyzed by Stiny and Mitchell, Frank Lloyd Wright’s Prairie Houses by Koning and Elizenberg, bungalow houses by Downing and Flemming, Queen Anne houses by Flemming, and Alvaro Siza’s houses at Malagueira by Duarte.\(^{19}\) Given that the work of this study’s focal faculty-practitioner, William Hajjar, shows strong evidence of shared shapes and transformation rules, a shape grammar–based methodology is appropriate for testing the hypothesis. For example, many of the houses designed by Hajjar can be considered in reference to shapes and rules as follows: a wing (i.e., a garage), connected through a breezeway (the connector, usually the main entrance) to the main volume. This main volume in his early work is a simple shoe box, which regardless of size (small or large) and orientation (parallel with or

---

\(^{17}\) This approach will be based on the idea of grammatical transformations developed by Terry Knight, *Transformations in Design: A Formal Approach to Stylistic Change and Innovation in the Visual Arts* (Cambridge: Cambridge University Press, 1994).


perpendicular to the main road), usually has a low-pitched roof. The main volume sometimes comprises two stories: the bottom story is usually the main living area (living room, dining room, and kitchen), and the top story is usually the sleeping area. Depending on the orientation and slope of the site, the bottom story may be a garage whereas the main living spaces may be located in the wing, the latter of which consists of one or two stories.

Research Questions

The defining purpose of this study is that of using a computational approach to characterizing the architectural language of the single-family residential architecture designed by Hajjar and built in State College in the mid-twentieth century. In order to fulfill this purpose, the following questions will be explored:

(1) Does Hajjar’s work in the stated context reflect a hybridity between modernism and traditional architecture? Based on the preliminary analysis and the author’s architectural intuition, which served as the springboard for this study, the answer to this question is “yes.” However, the more important question in this regard is this: Can this phenomenon be described accurately using computational methodologies?

An important broader question, though not at the center of this study, pertains to whether the shape grammar methodology can be used to verify/disprove and describe hybridity phenomena in architecture in general. Further, can the shape grammar methodology be used as an effective tool to generate hybridity in architecture?

(2) How did the technological context (limitations or innovations in terms of construction techniques, use of new materials, etc.) shape the layout of the houses, thereby contributing to this hybridity? And, what set of rules in the grammar reflect these technological limitations/innovations in Hajjar’s domestic architecture?
(3) Do the socio-economic context and issues related to education, gender, and race (in terms of the general profile of the clients) influence the design of domestic architecture in general and in State College in particular? And, what set of rules in the grammar reflect such possible influences?

Through this research study, the author will suggest answers to these questions by focusing on Hajjar’s architecture. Shape grammars will be used to explain how modernism (exemplified by European architects, such as Gropius and Breuer) and traditional American architecture (exemplified by American four-square plans) are integrated in Hajjar’s architecture. This account will be accompanied by a study of the subcultural context in order to understand how this hybridity emerged. Future research on other case studies, by the author or other scholars, will provide more comprehensive answers to these research questions and a basis for defining the architecture produced by faculty-practitioners in the mid-twentieth century in American college towns—an architecture referred to as “college town modernism.”

Methodology

Although the subject of the present study is architects and architectural styles in the mid-twentieth century in US college towns, the shape grammar concept is used as a computational design methodology to answer key questions related to the main hypothesis explored.

Objectives

The objectives of this study relate to exploring the residential architecture designed by William Hajjar, an architect teaching and practicing in State College during the focal period. An analysis of his work is presented as a pilot study pertinent to an analysis of the residential
architecture of other faculty-practitioners in US college towns in the same period. The central objectives are as follows:

- To further the field’s understanding of the architectural language of single-family residential architecture built in the mid-twentieth century in US college towns by defining the architectural language of single-family houses designed by Hajjar.
- To take steps toward verifying (or disproving) and describing the hybridity between European modern architecture and American traditional architecture in the work of Hajjar as a faculty-practitioner designing and building homes in a US college town during the mid-twentieth-century period.

**Hypothesis**

The single-family residential architecture designed by Hajjar in State College is not simply either modern or traditional in style. Instead, it reflects the shapes, rules, and features of both. His architecture shows the influence of modernist architects (European avant-garde immigrants, particularly Walter Gropius and Marcel Breuer) and American traditional architecture, (both popular pre-WWII houses, particularly American four-square houses, and popular post-WWII houses, particularly split-level houses).

It is important to note that Hajjar’s architecture cannot be described entirely in terms of formal influences. Other important factors were also at play, such as social context, lifestyle, and building technology.
Data Collection

The fieldwork for the proposed study began in 2014 using the following methods of data collection: architectural observations, archival searches, interviews, physical inventories, and visual documentation. In order to infer shape grammars, this research relies on orthographic drawings, including plans, sections, and elevations.

The author is an architect who has lived in three college towns (Ithaca, NY; Charlottesville, VA; and State College, PA) and began this research based on his own architectural observations and intuitions.

Archival Research

In any study related to the past, archival research plays a significant role in data collection. Given that the present study focuses on analyzing architecture through an examination of original orthographic drawings, much of the information needed can be found in archival materials. In regard to Hajjar’s architecture in State College, most of the existing information relevant to the research is available at Penn State’s Special Collections Library, where an archive of Hajjar’s work is housed.

Interviews

In the process of collecting information about Hajjar’s life and practice, the author did not conduct any formal interviews with people close to the architect. However, he did communicate on numerous occasions with Hajjar’s son, Mark, whose help was invaluable throughout this process. Mark, who donated extensive materials related to his father’s work while at Penn State to the university’s Special Collections Library, is knowledgeable about his father’s life and practice.
He consistently responded to the many questions put to him by the author via email and phone conversations. Another faculty member/architect knowledgeable about Hajjar’s work in the area is Louis Inserra, a student of Hajjar’s who worked in the latter’s State College office and later became a faculty member at Penn State and a practitioner in the area. As part of another research collaboration, through informal conversations with Inserra and other researchers working on the project, the author gathered information about Hajjar’s research, particularly his “Air-Wall” project built at Penn State in the early 1960s.

*Physical Inventories*

The author designed a data collection form in order to prepare a physical inventory of each building, thereby facilitating the process of analyzing spatial relationships and developing shape grammars. This data collection form and the information gathered through physical inventories are described in Chapter 3.

*Visual Documentation*

During the process of observation, data were collected and structures documented visually by taking photographs of the exterior and whenever possible the interior of the buildings of interest. As a form of data collection, visual documentation is important as backup evidence and confirmation, but also as a way of revealing visual information missed at the fieldwork stage.
Steps

The analysis of Hajjar’s life and work developed for the present study is organized according to the following steps:

1. A study of Hajjar’s life and architecture to identify other architects and styles likely to have influenced his work.
2. The development of the shape grammar for the houses he designed in State College.
3. The identification and/or development of basic grammars for some of the architecture likely to have influenced Hajjar’s work.
4. A comparison of Hajjar’s grammar to the grammars of these influences to determine similar rules, thereby determining the nature and extent of each influence.
5. The identification of aspects of the social and technological context that may explain these influences, such as lifestyle trends or available technologies.

It is important to note that whereas many shape grammar analyses developed previously relied on three-dimensional shape rules, the focus of the present study is on developing shape grammars to generate Hajjar’s floor plans and floor plans related to European modern architecture and American traditional architecture. The main reason for this focus is that based on the preliminary study, the influence of European modern architecture and the influence of American traditional architecture on Hajjar’s work can be explained effectively in relation to floor plans and interior layouts. Also, as explained earlier, many repetitive elements in Hajjar’s work can be explained in terms of the plans, such as the relationship between the garage, the entrance/breezeway and the main inhabitable space; the way in which the main space is divided into smaller rooms; and the allocation of interior functions.
Contribution to Knowledge

Between 1951 and 1963, William Hajjar designed and built thirty-three houses in State College, mostly for middle-class faculty members at Penn State University. In doing so, he contributed to the stability and popularity of localized/Americanized modern architecture by reshaping mid-twentieth-century modernism in the area and to some extent in the United States. The present study makes a contribution to the field in terms of both the focal context and the methodology used.

As noted earlier in this chapter, although the notion of architectural hybridity/duality has already been addressed in the literature, the hybridity between modern architecture and traditional architecture in US college towns has yet to be explored. As a result of this study, college town modernism could become a new category of mid-twentieth-century architectural styles in the United States. In this regard, the shape grammars of single-family residential architecture designed by the faculty-practitioners of the focal period can be analyzed and compared with both modern and traditional architecture. Through this process, similarities among and differences between them will be identified and analyzed to describe any shape grammars of college town modernism that emerge from this analysis.20

The methodology used in the present study is unique, not only in the field of architectural history, but also in design and computation. The shape grammar is used as a tool for verifying and describing hybridity as a phenomenon in architecture. The potential of shape grammars will also be discussed as an effective complementary tool that architectural historians can use to help verify in a mathematically rigorous way the formal and functional similarities between styles. In

short, it is proposed that shape grammars be used broadly in detective work, in verifying or
disproving hypotheses, similar to the process followed in Bruno, Sousa, Duarte, and Kruger’s,
study of Alberti’s influence on Portuguese classical architecture.21

Further, developing a methodology for verifying and describing the influences of modern
and traditional architecture on Hajjar’s domestic architecture will be useful in answering
questions in future studies, such as how influential was Hajjar’s architecture? And, in what other
work do we see hybridity of modern and traditional architecture as identified in Hajjar’s designs?
Further, by using transformation grammar, researchers can use the results of the present study as
a basis for providing solutions focused on the preservation, rehabilitation, and renovation of mid-
twentieth-century architecture in the United States.

**Dissertation Structure**

This study is presented in seven chapters. In addition to Chapter 1: Introduction, Chapter 2:
Background, and Chapter 7: Conclusion, there are four chapters, each based on a different
published paper: Chapter 3: Local Adaptation of Modern Architecture: A Grammar for Hajjar’s
Domestic Architecture is based on a paper of the same title presented at the 2018 eCAADe22
conference in Lodz, Poland. In this chapter, the author briefly explores Hajjar’s life and
architecture and analyzes his architectural language by describing the rules of a grammar
developed for Hajjar’s single-family architecture in State College. Chapter 4: Bauhaus
Internationalism to College Town Modernism: Exploring Bauhaus Culture in Hajjar’s Hybrid
Architecture is based on a paper of the same title presented at the 2019 CAAD23 Futures

---

22 The term eCAADe stands for Education and Research in Computer Aided Architectural Design in Europe.
23 Computer Aided Architectural Design.
conference in Daejeon, South Korea, and published as a chapter in *Computer-Aided Architectural Design “Hello, Culture”* edited by Ju-Hyun Lee (Springer). In this chapter, the author explores Gropius and Breuer’s single-family architecture in the United States by developing a grammar for their work and analyzes Hajjar’s architecture in relation to the influence of Gropius and Breuer in the US. This analysis is explained through a comparison of rules of the grammar developed for Hajjar’s work and the grammar developed for Gropius and Breuer’s work. Chapter 5: Using Grammars to Understand Localized Modernism: The Case of William Hajjar’s Single-Family Houses in State College, Pennsylvania, is based on a paper presented at the 2019 eCAADe conference in Porto, Portugal. In this chapter, the author explores American traditional houses of the context in which Hajjar practiced by developing a grammar for traditional houses in the area and analyzes Hajjar’s architecture in relation to contextual influences. This analysis is explained through a comparison of the grammar developed for Hajjar’s work and the grammar developed for the American traditional houses of the context. Chapter 6: Tracing Hybridity in Local Adaptation of Modern Architecture: Comparing Hajjar’s Architectural Language with European Modern Architecture and American Traditional Architecture is based on a paper accepted for the DCC20 conference in Atlanta, USA, and for publication as a chapter in the proceedings. In this chapter, the author verifies and explains the notion of hybridity in Hajjar’s architecture by comparing his architectural language with that of Gropius and Breuer in the United States and the American traditional architecture of the context.
Chapter 2

Background

Modern Architecture

The Beginning

Establishing a beginning point for the period of modern architecture, as both Kenneth Frampton and William Curtis have stated, constitutes the first problem in writing about the history of modern architecture. How we view and categorize modern architecture itself is a challenge. This study is not particularly about the history of modern architecture. Yet, it remains critical to be “consistent in the interpretation of the fact,” as Frampton notes. It is, therefore, necessary to describe modernism in architecture and to begin with a general idea of modernity, modernism, and modernization. This is essential, especially given that the term “modern” has been applied to architecture in many periods, as William Curtis states.

All new movements have their germinal source in the past. The beginning of modern architecture can be connected to the Enlightenment, when architects and theorists started to question the classical principles of architecture, or to the Industrial Revolution and the production and use of new materials in the building industry. Regardless of the starting point, transformations relating to the idea of modernity were the major force behind modernism. According to Jürgen Habermas, the principal characteristic in defining modernity is the “reflective treatment of tradition,” which refers to the notion that traditional is no longer

27 Some authorities, such as Nikolas Pevsner are content to trace the roots of modern architecture back to the work of William Morris in the 1860s. Others, such as Henry-Russell Hitchcock, Sigfried Giedion, Vincent Scully, Hans Sedlmayr, and Leonardo Benevolo trace it back a century earlier (Collins, *Changing Ideals in Modern Architecture*, 1965).
considered normal in an unproblematic way.28 This notion of modernity is revealed in the unconventional buildings that are the subjects of this study. Efforts to question conventional forms and methods of construction and the development of modern technologies and new materials each played a significant role in the creation and evolution of modern architecture.29

In the early nineteenth century, the Industrial Revolution and the developments associated with it had a profound effect on modern living environments. Developments relating to engineering, public utilities, and merchandising fundamentally changed the equipment that we use in the building industry, including in regard to kitchens and bathrooms, heating, lighting, plumbing systems, refrigeration, and water supply. Also, political and social issues defined modern living, thereby exerting an influence on modern house design. For example, the hall/parlor organization was popular in the mid-eighteenth to early nineteenth century: the hall was, as Dell Upton put it, the “center of the family’s social landscape.”30 From the second half of the eighteenth century, however, as Jan Gilliam notes, the parlor “lost some of its preeminence to the increasingly important dining room,” such that the dining room became the center of gatherings.31 Studying the social and technological context provides a basis for the innovations in terms of the interior layout of houses designed by Hajjar in the mid-twentieth century.

It was not until the turn of the century that a variety of structural inventions started to give rise to new forms in architecture. At this time, it was the European avant-garde who offered a new vision of architecture. Walter Gropius, founder of the Bauhaus and one of the “pioneers of modern design,” according to Nikolas Pevsner, described the emergence of modernism as follows: “The morphology of dead styles has been destroyed; and we are returning to honesty of

28 J. Habermas, *The Philosophical Discourse of Modernity: Twelve Lectures*, trans. Frederick Lawrence (Cambridge: MIT Press, 1987). He continued by saying that modernity is the result of the “universalization of norms of action,” and in relation to that socialization is oriented to the formation of an ego identity.
thought and feeling.” In Gropius’s view, the New Architecture, as he referred to it, was not the result of innovation on the part of a handful of architects, but “simply the inevitable logical product of the intellectual, social and technological conditions” of the time.

Many architects and historians credit European émigrés with bringing modernism from Europe to the United States, “as if in a suitcase,” with the 1932 exhibition *Modern Architecture* at the New York Museum of Modern Art (MoMA), and then teaching it to their young American students, such as those listed in Chapter 1 of the present study. However, scholars such as Gwendolyn Wright see this as a myth and argue instead that modern American architecture has its origins in late nineteenth-century modernization in the aftermath of the Civil War, after which the United States became a modern nation, especially in its cities where architecture helped represent and propel this transformation.

Whether or not modernism had its roots in Europe, European architects were interested in building technology in the United States, especially in the building methods used there. European avant-garde architects viewed Midwestern factories and grain elevators as “the magnificent evidence of a new age.” From the late nineteenth century onwards, most of the world has considered the United States to be the epitome of modernity, with architectural technology playing a key role in shaping this view: “towering skyscrapers, rationalized factories, vibrant settings for popular culture, verdant parkways and mass-produced, moderate-cost dwellings.”

The history of modern architecture, especially in the United States, however, is tied from the early twentieth century onward to Frank Lloyd Wright and his Prairie style of architecture.

---

35 *Modern Architecture: International Exhibition* took place in 1932 at the Museum of Modern Art (MoMA) in New York and was curated by Henry-Russell Hitchcock and Philip Johnson. The exhibition and its accompanying catalogue, *The International Style: Architecture since 1922*, introduced a European avant-garde style characterized by simplified geometry and a lack of ornamentation known as the “International Style.”
36 Wright, *USA*, 17–19.
37 Ibid., 7.
38 Ibid., 8.
The Prairie style of architecture is generally characterized by a low-pitched or flat roof accompanied by wide overhanging eaves, cornices, and an emphasis on horizontal lines. Houses in this style were meant to complement the surrounding landscape. Prairie-style architecture (or the Prairie School) was exemplified by Robie House and Darwin D. Martin House. Wright’s Prairie style started to shift Americans’ ideas of house design away from nineteenth-century Victorian and revival styles towards a new twentieth-century modern design.

Publications such as Henry-Russell Hitchcock’s 1929 book, *Modern Architecture: Romanticism and Reintegration*, and architecture journals, such as *Architectural Record*, which began a “new chapter” with the declaration that “Modernism is an attitude of mind—the scientific attitude” reflected a turning point for modern architecture in the United States and worldwide.

The period between the end of World War I and the Wall Street Crash of 1929, as scholars such as Hayden, Curtis, Jackson, Roth, and Collins point out, was a boom period for building investment in the United States. This was especially evident in the profiles of large cities, the growth of downtown skyscrapers and highways, and also in the creation of suburban sprawl. However, among other social-cultural phenomena, the economic crash and the ensuing Great Depression at the end of the 1920s and throughout the next decade had a profound effect on arts and architecture in the United States. Approximately ninety percent of the country’s architects and engineers were unemployed in the early 1930s. President Franklin Roosevelt’s New Deal called for direct action to mitigate the effects of the Depression era; however, it was not until the start of World War II that the country began to recover.

---

41 Wright, USA, 82.
43 Wright, USA, 113.
In the early 1930s, Europe avant-garde architects such as Mies van der Rohe would “return on several occasions to photomontages of landscapes seen through transparent structures.”\(^{45}\) However, in the United States, architects struggling in the context of the economic depression were trying to do things other than construct buildings. Wright, for example, started writing his autobiography and established his Taliesin Fellowship, both of which influenced the next generation of American architects. However, under the New Deal, there was a push for public projects, and modern architecture helped to shape these projects, which continued to be built throughout the 1940s and 1950s: Examples include Samuel Wiener’s Municipal Incinerator in Shreveport, LA (1935), Roland Wank’s powerhouse and gantry crane for the Kentucky Dam (1939–1944), and Ely Kahn and Robert Jacobs’s Municipal Asphalt Plant in New York City (1944). Wright’s Johnson Wax Administration Building in Racine, Wisconsin (1936–1939), also “embodied the New Deal’s call for enlightened work relations,” as a sudden economic surge for the company.\(^{46}\)

An important difference between European modernism and American modernism, as G. Wright states, pertains to regionalism: Modernism in the United States “remained strongly regional throughout the 1930s.”\(^{47}\) Regionalism in architecture is generally about the context and customs of constructing buildings in a region. G. Wright argues that what Neutra and Schindler—later joined by Gregory Ain, Raphael Soriano, and J. R. Davison—created in Los Angeles is a regionalized modernism. Similarly, Cliff May’s modern low-lying ranch house is a reinterpretation of local history. Albert Frey’s resort in Palm Springs and the work of William Wurster, Harwell Harris, Gardner Dailey, John Frank, and others—exhibited in the San Francisco Museum of Art in 1942 and 1949 to promote the domestic architecture of the Bay area—should be included in this notion of regional modernism.

---

\(^{45}\) Curtis, Modern Architecture, 309.  
\(^{46}\) Wright, USA, 120.  
\(^{47}\) Ibid., 127.
The design of modern American dwellings evinced an attitude that inclined more toward domesticity than toward a stylistic idiom. The open flow of space on the ground level typical of these dwellings expressed a sense of informality, as did the continuation of indoor to outdoor space, as G. Wright explains. An industrial system of modern construction joined with simple, natural, and often local materials, such as wide cedar and spruce planks in the Pacific Northwest, blank stucco walls in the Southwest, rough fieldstone in Pennsylvania, and clapboard siding in New England.\textsuperscript{48}

Wright and other American modernists were not the only architects advocating this regional modernism. Even the International Style architects who had emigrated from Europe, such as Gropius and Breuer, were applying the principles of European modernism to American regionalism to some extent: After moving to the United States, Gropius designed his own house in suburban Lincoln, MA, partnering with Breuer, while they were teaching at Harvard’s Graduate School of Design (GSD). Gropius’s idea of “light construction, full of bright daylight,” which he had conceived of during his early days at the Bauhaus, can be seen as the force behind the design ideas. They also used design elements of the Bauhaus/International Style architecture, such as white planes, transparent glass walls, and flat roofs. However, here, they incorporated local clapboard and fieldstone, as well as that all-American vernacular element, as G. Wright calls it, the screened porch.\textsuperscript{49}

\textsuperscript{48} Wright, \textit{USA}.
\textsuperscript{49} Ibid.
Postwar United States

We must make it absolutely clear, to ourselves no less than to others, that first class architecture is necessary in war, not just for our fun or to line our pockets, but because good buildings can help to win the war.\(^{50}\)

Modernism in the United States was to be accepted step by step by practicing architects, architectural students, and architectural schools. Later, in the 1950s, not only did journals related to practice, such as the *AIA Journal*, promote modern architecture, but so did journals related to architecture education, such as the *Journal of Architectural Education*. The journals showed recently built modernist projects nationwide, especially on campuses, and described modernist problems given to architecture students and the projects the students produced in response.

Accordingly, in the *Journal of Architectural Education* in spring 1960, Arthur E. Burton, an assistant professor and the Leonard Wolf Head of the Department of Architecture and Architectural Engineering at Iowa State University, published “Full-Scale Prototype Structures” in which he described the importance of constructing such prototypes in modernist architecture pedagogy. He published an example of a modernistic design structure/prototype that he and his students had built.\(^{51}\) Similarly, Ernest Gelotte, a professor at MIT, published examples of work on structures and structural frames to teach students sophisticated techniques for structural analysis. He also presented images of the model he and his students had built together in the late 1950s.\(^{52}\)

Certainly, architecture programs still included plenty of faculty members who remained attached to the traditional Beaux-Arts system of pedagogy. However, it was hard to reject modernism in the postwar period. Students had access to new publications about the work of modern architects including Henry-Russell Hitchcock’s *In the Nature of Materials: The Buildings of Frank Lloyd Wright 1887–1941*, which was originally published in 1942. Further, the *AIA*
Journal, the Journal of Architectural Education, Architectural Review, Pencil Points, and other architectural journals were advocating for modernism in the 1950s and 1960s. Postwar demands also changed the nature of architectural practice given the need to build more quickly and cheaply than ever before by taking advantage of more industrialized materials. The first group of students trained in accordance with the Bauhaus legacy or alternative models in the United States started practicing and teaching throughout the country. Through all these developments, modernism, indeed, became the postwar norm over time.

To marry a form-giving language of architecture to a program, many modern architects brought a new emphasis on functionalism to their projects. However, Louis Sullivan’s “form follows function” became “function dictating form” in some of their work.\textsuperscript{53} After World War II, as modernism became international—both literally in terms of the geographical domination of the style and conceptually in terms of the architectural ideas—functionalism became more pragmatic. William Curtis asserts that World War II “destroyed a previous social and economic order, and to that extent eroded some of the impulses which had brought modern architecture into existence.”\textsuperscript{54} Although it remains difficult even in the present day to assess the full impact of World War II on architecture, the war wreaked destruction in Europe—both physically and culturally—such that significant architectural production was necessary. For this reason, functionalism became an important aspect of modern architecture.

In the postwar financial and business environment in the United States, a “system revolution” began through which the concept of the corporation underwent a fundamental change. Large architecture-engineering-construction companies built generic modern structures designed to be high-capacity and flexible in nature, thereby “converting a wartime idea to peacetime prosperity.”\textsuperscript{55} Examples include Pietro Belluschi’s Equitable Building (today the Commonwealth

\begin{footnotes}
\item[53] Christine Norberg-Schulz, Meaning in Western Architecture (New York: Rizzoli International Publications, 1974), 187.
\item[54] Curtis, Modern Architecture, 395.
\item[55] Wright, USA, 156.
\end{footnotes}
Building) in Portland, OR (1944–1948), Mies van der Rohe and Philip Johnson’s Seagram Building in New York City (1954–1958), and Skidmore, Owings and Merrill’s (SOM) Union Carbide Building in New York City (1960). The “Rolls Royce” of contemporary buildings, as Lewis Mumford described it, the Seagram Building reduced architectural form to its simplest, most perfect elements, creating a grammar and a poetry for modern architecture.  

As Donald Albrecht argues, the war acted as a catalyst for both postwar suburban development and modern architecture, “incorporating the avant-garde into the mainstream.”  

After the war, firms such as SOM, which was responsible for the design of several wartime projects, embraced the war’s modernist aesthetics, and functioned as large corporate offices, as Albrecht notes. On the other hand, architects such as Louis Kahn, who had designed housing for war workers, tried to temper the postwar power of modernism by referencing history and monumentality. This postwar architecture was referred to as the “architecture of bureaucracy” and the “architecture of genius” by Henry-Russell Hitchcock in an article published in Architectural Review in 1947.

After World War II, the GI Bill of Rights promised generous education, health, and housing benefits to 11 million returning veterans. Given that the country did not have enough facilities to make good on the government’s promise, the GI Bill gave rise to a construction boom. In response to the postwar housing growth, the Housing and Urban Redevelopment Act was passed in 1949. This act, which was part of President Harry Truman’s Fair Deal, expanded the federal role in mortgage insurance and issuance and in the construction of public housing. Although large-scale urban renewal projects in the US had begun in the interwar period, the Housing Act set in motion an urban renewal program that reshaped American cities through, for

---

example, joint federal and local government efforts to “modernize” downtown areas and boost property values. Less than a decade later, in 1956, President Eisenhower’s Federal Aid Highway Act facilitated the construction of a new highway system, which accelerated urban sprawl and suburbanization, especially around large metropolitan areas.

In the postwar period, multiple technologies, materials, and machinery, whether products of the war or improved on during that time, were critical to the development of architecture in the United States, as were governmental policies directed at housing for returning veterans. The postwar housing boom required faster and at the same time more cost-effective construction methods, which in conjunction with the availability of new materials facilitated a transition to new kinds of production and even to the new style of architecture. “Design Review,” a monthly column published in The Architectural Review beginning in September 1944, focused on new materials and their possible uses in architecture, thereby indicating the significance of these materials—produced both in wartime and afterwards—to the development of mid-century architecture in the United States.

Schools of Modern Architecture

As explained earlier in this chapter, it is difficult to come up with a single definition of modern architecture especially in the context of the United States. Throughout the twentieth century, modernism was defined in multiple slightly different ways associated with different branches or schools of modern architecture. In July 1953, R. J. Anderson, editor of Architectural

59 Wright, USA, and Barbara M. Kelly, Expanding the American Dream: Building and Rebuilding Levittown (Albany: State University of New York Press, 1993).
61 Albrecth, World War II and the American Dream; Cohen, Architecture in Uniform.
Forum, noted that it was “no longer [...] possible to explain modern design as ‘simply functional,’” and he announced that Forum would soon begin to publish a new series of discussions on this theme. He also predicted that “Our architecture someday will take an important place in history with the Greek, the Gothic and Renaissance.” The first of this series was “The Six Broad Currents of Modern Architecture” by Eero Saarinen, one of the younger architectural leaders of the time. Saarinen emphasized the notion that architects were at the beginning of a whole new period of design. He believed that historians would view the more traditional architects of this time as “scenery builders buil[ding] Gothic colleges and Roman banks—false façades borrowed from a former time” and that historians would view such buildings as unacceptable because they fail to “even recognize the spiritual side of architecture.”

Saarinen celebrated a small group of architects, whom he saw as distinguishing themselves not by the size of their buildings, but by their intellectual and creative contributions to the field—architects he referred to as “form-givers.” Saarinen went on to describe six easily discernible branches of modern architecture and their practitioners: Frank Lloyd Wright and “organic unity,” William Wurster and Pietro Belluschi and “handicraft architecture,” Alvar Aalto and the “European individualists,” Le Corbusier and “function and plastic form,” Gropius and “an architecture for the machine age,” and Mies van der Rohe and “the form-givers.” He categorized these into two main groups: the first three as “individualists, romanticists or humanists,” and the last three as “classicists or functionalists [whose work was] sometimes labeled as the ‘International Style.’”

The work of Buckminster Fuller, Philip Johnson, and Louis Kahn, described as the “eclipse of the new deal” by Frampton, and also the work of Pier Luigi Nervi, can be added to

---

68 Ibid.
69 Ibid., 111.
Saarinen’s schools of modern architecture. Saarinen did not allocate a separate school for Fuller and Nervi. However, he did describe them as engineer-scientists, referring to their work as “other investigations, which will play a dominant role in the shape of things to come.”

Understanding these branches is helpful in outlining the boundaries for any case study of modern architecture, particularly one that refers to a process of hybridization in architecture, including the present research on college towns.

The College Town: An American Phenomenon

The college town, in its instantiation as an American phenomenon, is a community that is heavily dependent on the university it hosts. It is a particular type of small town, one whose population is dominated by university faculty, students, and staff. College towns tend to differ from other towns and cities in their respective regions. That is, although many American college towns are situated in remote areas, the young and diverse population, the highly educated work force, the general absence of heavy industry, and the existence of cultural amenities, many of which are characteristic of large cities, set them apart from the rest of the country’s small towns.

College towns have characteristics in common both with small towns and with cities: For example, in terms of population, rural/suburban setting, and most of the infrastructure, they are comparable to other kinds of small towns. However, in terms of culture and education, they are more comparable to cities. It is important to note that colleges differ in terms of size, mission, degrees and fields of study, entrance requirements, tuition costs, etc., such that they attract different kinds of students and faculty who, in turn, “shape the character of the towns in which they are located.”

---

68 Ibid., 114.
70 Blake Gumprecht, The American College Town (Amherst and Boston: University of Massachusetts Press, 2008), 22.
The idea of university life and of the university community, as Laurence Brockliss argues, does not have its origins in the US, but in the medieval European universities where students and teachers lived, worked, and studied together in a “cloistered environment.” Yet, the comprehensive planned modern university campus, or what Thomas Jefferson called the “Academical Village,” is primarily an American phenomenon. Beginning in the colonial period, American colleges followed the English “collegiate” model, even when larger universities were developed in the United States. Although American colleges followed English precedents, in many ways they developed their own American character. For example, instead of separate colleges created in separate locations, in the United States, colleges were clustered together at a university. Some university campuses were built in downtown city areas. However, as another innovation, or another break with European tradition, most campuses in the US were built in separate communities or towns in the countryside or even in the wilderness.

Modern houses in college towns are usually the result of a specific set of conditions, especially in neighborhoods near the universities: It is reasonable to speculate that several faculty members in these small towns were pioneers in their fields at the time. It can be argued that innovative people want to be seen as risk-takers, and some of these wanted to express this quality by, for example, building a house in an unconventional style. John Jakle, in a study of Urbana, Illinois, observed that faculty members were more likely than other townspeople “to own houses

---

72 Chapman, American Places.
73 The English college structure is rooted in the medieval cloistered environment, where students and teachers lived and studied together in small, tightly regulated colleges.
75 Gumprecht, The American College Town.
76 Peter Brandon and Shu-Ling Lu, eds., Clients Driving Innovation (Oxford, UK: Wiley-Blackwell, 2008); and Susan Rose-Ackerman, “Risk Taking and Reelection: Does Federalism Promote Innovation?” Journal of Legal Studies 9, no. 3, 2008: 593–616. Although this idea sounds like a general assumption, it is based on evidence founded in preliminary studies. As an example, Carl Sagan, the American astronomer and scientist, and a faculty member at Cornell University in Ithaca, New York, hired Julian de la Fuente to design his home studio. To name a few other people in Ithaca, Walter Crissey, preeminent waterfowl population researcher and pioneer of the use of aircraft for wildlife studies, hired Raymond Viner Hall in 1941 to build the first modern house in the area. James Lynn Hoard, a chemistry professor at Cornell and an expert in crystallography whose work helped to explain crystalline and molecular structures, also hired Hall to design a modern house in the area.
that were architecturally distinctive as a way to set themselves apart as an ‘educated gentry class.’” Furthermore, general awareness of the modern movement through an architecture program might be another important condition in towns where social circles in which people are very connected to each other are likely to exist. This is in addition to the direct relationships between the architects and their clients, the latter of whom were also faculty members in some cases. Most college towns have at least one older neighborhood near campus that is home to large numbers of professors, for example, the College Heights Historic District in State College. In fact, nearly half the houses Hajjar designed in the State College area are located in this neighborhood, which expanded during the mid-twentieth-century period.

As Blake Gumprecht explains in his extensive study, *The American College Town*, “College towns are largely an American phenomenon,” which makes them an appropriate context for studying American architecture in the mid-twentieth century. Overall, the key characteristics of American college towns can be summarized as follows:

- Most college towns have little heavy industry, and college town residents are more likely to work in white-collar than in blue-collar jobs. Especially in the post-WWII era, when university enrollment increased, college towns became more dependent than before on the universities they hosted for economic survival.

- College towns are unusual places: Because of their demographic composition, many are full of activists who are not necessarily aligned with mainstream values.

- College towns generally offer a high quality of life: They are usually known for having good schools, safe streets, lively downtown areas because of the youth population, nice

78 Nearly 80% of the clients for whom Hajjar designed houses in State College, Pennsylvania (in College Heights, referred to as the “historic district,” and also in the Holmes-Foster neighborhood) were faculty members in various fields at Penn State. Similarly, in College Station, Texas, many of the houses designed by the CRS firm and by other faculty-practitioners, especially those in the Knoll neighborhood and the College Park area, were designed and built for faculty members at Texas A&M.
79 Gumprecht, *The American College Town*, 16.
81 Ibid.
residential neighborhoods usually adjacent to the universities where many faculty members live, and unusual cultural opportunities and plentiful recreational facilities given their small size.  

The “college towns” in the present study are generally relatively small, and many are located in rural areas. Studying the sub-culture context of college towns, especially of State College, is important to understanding the architecture produced in that context. The shape grammar technique is foundational to the study as a way to trace the formal and functional effects (and similarities) of European modern architecture and American traditional architecture on Hajjar’s single-family architecture. However, to describe some of the shape rules, a consideration of local aspects is also necessary if we are to determine the relationship between those effects and the immediate local context.

Architectural Pedagogy in the United States

Given the returning veterans and the GI Bill, the postwar period brought with it the need to expand university programs. In response to the accompanying expansion in enrollment, architecture-degree programs, along with many other university programs throughout the country, hired new faculty members, many of whom were young architects fresh from graduate school. These recent graduates had studied architecture at a time when US architectural pedagogy was undergoing a transformation in terms of its focus: The Beaux-Arts approach that had long held sway was giving way to modernism. It was during this same period that the first group of US

82 Ibid.
83 “University town” is perhaps the correct term, as these towns usually host universities (mostly land grant). However, the term “college towns” is more common. Additionally, in the present study, the term “college towns” reflects the sense of small and often remote towns better.
students graduated from architecture programs in which European immigrants who were proponents of the avant-garde exerted a significant influence on subsequent architectural practices in their roles as teachers, researchers, and practitioners.\textsuperscript{84} These young architects who graduated from the “less conventional” architecture schools in the US, as Anthony Alofsin calls them, were hired by architecture programs to teach throughout the country, including in college towns.\textsuperscript{85}

In regard to architectural education in the United States, it is important to note that up until 1860, architecture education consisted entirely of completing an apprenticeship with a practicing architect supplemented by reading books, traveling, and participating in occasional public lectures.\textsuperscript{86} As Mary Woods states, in the United States, office experience was the most common way to prepare architects practicing in the late nineteenth and early twentieth centuries.\textsuperscript{87} Office experience served as a bridge, and to some extent still does, between the studio and the construction site. However, by 1930, there were sixty architecture programs in the country and the practice of architecture education had transitioned from the apprenticeship model to a course of study at a college or university with a “formal curriculum in architecture.”\textsuperscript{88} This formal architecture education derived from two distinct sources: the French system of École des Beaux-Arts, which treated architecture as a fine art, and the German polytechnic system, which treated architecture more like a technical science.

\textsuperscript{85} The most prominent schools in the nation in terms of training students in modernist architecture were Harvard’s Graduate School of Design (GSD) and Chicago’s Armour Institute (later IIT). Anthony Alofsin explains that in addition to these two schools, “several less conventional schools also appeared” in that time period: The Institute of Design in Chicago (later merged with IIT), Black Mountain College (a design school rather than an architecture program), Frank Lloyd Wright’s Taliesin, MIT, and the Georgia Institute of Technology.
\textsuperscript{88} Lewis, “The Battle Between Polytechnic and Beaux-Arts,” 68.
As Michael Lewis notes, although the German method was more influential, at least in terms of the number of followers, and its influence was felt earlier, the impact of the École method in the United States is better known. In the early twentieth century, the architects with the greatest prestige had studied at the École des Beaux-Arts in Paris, or at least at US schools that followed the École method.

MIT’s pioneering architecture program, established in 1865, was the first to use the Beaux-Arts system in the United States. William R. Ware took the same approach at Columbia University where, in 1881, he established the sixth architecture program in the United States. At the University of Pennsylvania, which had first offered architecture courses in 1868 and established its architecture program in 1890, the École method also dominated the curriculum. At Harvard, where architecture courses had been introduced in the late 1890s, however, the situation was somewhat different: Driven by the vision of H. Langford Warren, an architectural historian who had worked for H. H. Richardson, the program was relatively independent in that it did not slavishly follow the École.

In 1937, with the appointment of Walter Gropius as the director of its Department of Architecture, Harvard’s GSD became the nation’s most prominent school training students in modernist architecture. With the exception of Harvard and the Armour Institute of Chicago, the latter of which was led by Mies van der Rohe from 1938 to 1959, most US architecture programs remained under the Beaux-Arts system of education until after World War II. The fact that Harvard’s GSD and the Armour Institute were the two pioneer schools in training students according to modernism shows the importance of Gropius (and Breuer) and van der Rohe to the United States, and also the importance of the Bauhaus legacy to the country’s architecture

89 Ibid.
pedagogy. Although many other schools continued to focus on the Beaux-Arts, some architecture professors and architecture programs followed Gropius and Mies by teaching students according to the principles of modern architecture. Among the professors teaching with this emphasis was Lawrence Anderson at MIT. With William Wurster’s appointment as Dean in 1945, MIT became the third major program to promote modernism. However, as Alofsin notes, “at MIT, a longtime bastion of the French approach, Lawrence Anderson was instrumental in bringing in modernist thinking.” 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. He introduced a new system to review the students’ work that relied on inviting outside critics to MIT for this purpose. On this basis, Gropius and Breuer were among those frequently invited to MIT such that the students (including Hajjar) were introduced to the philosophy of modern architecture that these two architects expounded. Anderson was especially interested in Scandinavian modernism. With Wurster, he paid a visit to Alvar Aalto in the late 1930s and was instrumental in the latter’s appointment as a Research Professor in Architecture in 1940. Anderson worked hard to bring a modern outlook to the MIT program, and in 1939 (with Herbert Beckwith) he designed one of the first modernist buildings on an American campus, i.e., MIT’s Alumni Swimming Pool.

---

95 President’s Report, Massachusetts Institute of Technology, October 1940.
96 Alofsin, “American Modernism’s Challenge to the Beaux-Arts.”
The Bauhaus Legacy

Finding solutions to the problems experienced by the working class 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. 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 and creative expression.97 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 of the teachers emigrated from Germany to teach in other countries such as the United States. By the time World War II broke out, most of them were teaching at major schools in the United States, influencing 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.

Three former Bauhaus faculty members who played an important role in American architecture were Walter Gropius, Ludwig Mies van der Rohe, and Marcel Breuer. Their contributions were supported by the efforts of three other Bauhaus teachers: Josef Albers and László Moholy-Nagy, and also Herbert Bayer (a graphic designer who studied under Kandinsky, Klee, and Moholy-Nagy at the Bauhaus and became the director of printing and advertising).98

Other leaders of modern architecture who had been part of the Bauhaus also immigrated to the United States and had an influence on 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.

Having identified the US as offering a receptive environment for their work and views, the German immigrants arrived in the country in the late 1930s. The battle between the ancients and the moderns that had dominated professional American publications throughout the decade was almost over. From about 1937, the editorial balance of the magazines reflected the attitudes of the profession toward modern architecture. Therefore, there was a general awareness and acceptance of what Gropius, Mies, and Breuer had to offer.

Houses in the United States in the Mid-Twentieth Century

No account of the new residential architecture of the late 1920s and 1930s in the United States would be complete without referencing both the influence of European design and that of Frank Lloyd Wright’s early work. With experiments in the use of new materials, European modern designs, and Frank Lloyd Wright’s work, contributed in one way or another to the evolution of modern architecture in the United States, especially to domestic architecture.

---

College, in North Carolina, where he trained many relatively well-known twentieth-century American artists, including Robert Rauschenberg. Albers joined Yale University as head of the Department of Design in 1950. Moholy-Nagy, who was influenced by constructivism and was a strong advocate of the integration of technology and industry into the arts, moved to the United States in 1937. With a recommendation from Gropius, he became the director of the New Bauhaus in Chicago, although this group lost its financial support after a year. In 1939, Moholy-Nagy opened the School of Design in Chicago, which in 1944 became the Institute of Design and later part of the Illinois Institute of Technology, the first institution in the United States to offer a Ph.D. in design.

Walter Peterhans and Ludwig Hilbersheimer, who served as Mies’s staff during his brief tenure as the Bauhaus director, joined him during the time he spent on the faculty at the Illinois Institute of Technology. Eric Mendelson should also be included as one of the German leaders of the modern movement in the twentieth century. The Austrian, Fredrick Kiesler should also be mentioned as an artist whose influence extended across the entire scope of the visual arts, including architecture, scene design, sculpture, and painting. Hans Hofmann, another German artist, also outside the Bauhaus, deserves to be mentioned for his influence on American painting in the 1940s and 1950s.

Jordy, “The Aftermath of the Bauhaus in America.”

Usonian Houses

Given his interest in everyday middle-class houses, Frank Lloyd Wright championed simplified construction and focused on creating the American dream house based on that principle. He repeatedly claimed that he would rather “solve the small problem than build anything else I can think of.” His efforts in this direction started with his Prairie-style houses and continued with his Wisconsin project of American system-built homes, the latter of which constituted his response to his clients’ desire for pre-cut components for mail-order housing. He continued with his California textile block houses—a series of houses designed in the 1920s in southern California based on hand-cast concrete blocks—and later achieved the peak of simplified construction with his Usonian Houses. Wright’s Usonian buildings form a group of low-cost houses designed in the context of the housing boom of the mid-twentieth century. Taking his cues from Sullivan’s organicism, Wright, with the horizontal lines of his Prairie Houses, introduced a new domestic architecture to the United States—an architecture inspired by nature. In the last decade of his life, by which time he was well known internationally, Wright was still interested in expressing the American dream through simplified construction, or what he called “Usonian Automatic,” i.e., self-built houses offered as the modern answer to pre-fab construction. In Thomas Hine’s view, Wright’s efforts in this direction were more successful in some ways than in others:

Frank Lloyd Wright’s dream of beautiful, affordable houses for all never materialized, but many of the qualities of his pre–World War II “Usonian” designs appeared in postwar houses. These included walls of windows, continuous interior spaces, low, mantel-less,

---

103 Secrest, Frank Lloyd Wright, 533.
106 The term “Usonian Houses” usually refers to a group of sixty or so family homes designed by Wright. To control costs, he included neither an attic nor a basement, and the design boasted very little in terms of ornamentation. The first house of this kind was Jacobs House, built in 1936 (Bruce Brooks Pfeiffer, ed. Frank Lloyd Wright on Architecture: Selected Writings 1894–1940).
107 Secrest, Frank Lloyd Wright.
asymmetrical fireplaces, indirect lighting, bracket-mounted shelving, and, most important of all, a general air of informality and openness.\textsuperscript{108}

**Post–World War II**

The design of single-family houses underwent a significant change in the mid-twentieth century in the United States, an era referred to as *populuxe* by Thomas Hine.\textsuperscript{109} The US government’s response to the Great Depression and World War II gave rise to a postwar housing boom, which, in turn, required faster and at the same time more cost-efficient construction methods. In conjunction with the availability of new materials, these methods produced new types of single-family houses, including ranch, split-level, and raised ranch.\textsuperscript{110} The boom also provided more opportunities for contractors to build, and perhaps, more opportunities for architects to design.

In the post–World War II era in the United States, popular home magazines, interior decorators, architects, appliance makers, and building-material manufacturers joined forces with the federal government to fuel what became the greatest surge in home construction since the 1920s. The legacy of thirty years of depressed hopes was replaced by a new vision of the ideal home: the “Dream House of the Future.” Further, the need to keep construction costs low during the 1930s drove the development of new building materials, among which were prefabricated window units, weather-resistant exterior plywood, latex glue and caulking, composition-board products, and improved drywall plasterboard.\textsuperscript{111}

The new materials and new construction methods borrowed from wartime machines and technologies advanced the growth of the building industry but at the same time may have

\textsuperscript{109} Ibid.
\textsuperscript{111} Clark, *The American Family Home*, 193–94.
weakened housing designs, especially from the perspective of elite modernist architects.\textsuperscript{112} Joseph Hudnut, then Dean of Harvard’s GSD, noted in \textit{Architectural Record} that the “cloudburst of new houses” lacked “the idea which is [the] essential substance of a house.” In his view, the new building materials, some of which brought a new strength to construction, should provide architects with greater freedom to model and define space, lending it “an ethereal elegance unknown to the historic architecture.” Critics such as Hudnut expressed what they saw as the need for a new aesthetic idea, whereas others focused on new functions. Royal Barry Wills stated that architects should design rooms in the modern house with multiple functionalities—e.g., a study–guest room, a kitchen–laundry room, a sewing room–playroom, and terraces that could serve as extensions of the living room, dining room, or bedroom.\textsuperscript{113}

While American people were dreaming about home ownership and the building industry was trying to sell them dream homes, there was a debate between the present and the arrival of the “future” in postwar US advertising: the notion of a “house for the future” rather than a “dream house.”\textsuperscript{114} Paul Zucker, publisher of \textit{The New Architecture and City Planning} (1944) and organizer of an important wartime symposium on planning, noted:

\begin{quote}
It is necessary here to protest energetically against one method of evading the issue, fostered by so many articles in popular magazines today, about the “house of to-morrow” and the “city of to-morrow.” There are very powerful vested interests more concerned in marketing a particular commodity than in promoting a really essential change.\textsuperscript{115}
\end{quote}

The architect’s problem was (and still is) that of integrating his/her own expertise and vision with the client’s dream. In the mid-twentieth century, several magazines, including \textit{Ladies Home Journal} and \textit{Better Homes and Gardens}, ran social study surveys to explore this very issue.

\textsuperscript{112} Corporate laboratories and individual inventors during the war focused on developing new materials and techniques, such as Styrofoam, Saran, and molded plywood, and on increasing the capacity of existing materials, such as fiberglass, aluminum, and acrylic sheeting. For an overview of wartime products useful in architecture, see Donald Albrecht, \textit{World War II and the American Dream: How Wartime Building Changed a Nation} (Cambridge: MIT Press and National Building Museum, 1995).

\textsuperscript{113} Clark, \textit{The American Family Home}, 197–200.

\textsuperscript{114} Andrew Shanken, \textit{194X: Architecture, Planning, and Consumer Culture on the American Home Front} (Minneapolis: University of Minnesota Press, 2009).

According to the responses, the typical American looking for a new house who had already consulted an architect or contractor was still attracted to the Cape Cod style. However, buyers wanted more space and also favored the Southwest ranch house. And, most people planned to go to the suburbs or the countryside where they could obtain the larger lot needed for a more spacious home.

As Clifford Clark argues, although most families preferred eating their breakfast and lunch in the kitchen, most, even those planning to build a dwelling for less than $5,000, wanted a separate dining area. They also hoped for a living room, kitchen, bathroom, and three bedrooms on the first floor. In the 1940s and 1950s, architects were not the only ones discussing family life: doctors, social workers, sociologists, psychologists, appliance manufacturers, and even—perhaps especially—the writers of television series and advertisers suggested a new image of the ideal American family. Companies brought a new sensibility to advertising their products in order to show, for example, that using their new home appliances was interesting, modern, convenient, efficient, and even fun.

In the 1950s, it became the responsibility of architects and planners in the building business industry to create a “rosy image of the bucolic middle-class suburban utopia.” It is important to note that the average cost of construction had doubled since the 1940s. Developers and architects were, therefore, interested in ways to hold costs down while improving quality. The growing use of the resin-bonded plywood that had been developed during wartime as well as prefabricated subassemblies including window units, closets, and kitchen cabinets was a result of this goal.

To meet the need for low-cost and speedy construction, houses with low-pitched roofs were built on concrete slabs, such that traditional storage space was lacking. To compensate,

---

116 Clark, *The American Family Home*. Architects who were trying to redefine modern American architecture did not feel any responsibility to design rosy images, but a new and modern house for American people to meet the needs of modern life.
builders included more cabinets and storage areas, and to provide a sense of spaciousness, open-plan layouts and large window areas were used. Through an open plan and a centrally located circulation path, the functional size of the main area, including the living room, dining room, and bedrooms could also be reduced. Standardization made it possible to design the rooms so that they would be small in terms of both length and width and with minimum clearance. Changes to the layout of homes in the mid-twentieth century also changed ideas of privacy. Spaces previously considered private became public; for example, the kitchen became a showcase of modernity and, therefore, more open to the living room. Therefore, these spaces were integrated into the decorative scheme of the house.

The new necessities of modern life and the new features of modernist design eventually changed the norms of domestic architecture. It can certainly be argued that traditional architecture was influenced by modernist ideas. However, it is more accurate to say that modernity or modern life wrought changes in middle-class American lifestyles and that American lifestyles wrought changes in traditional architecture. Instead of a standard plan behind a standard, symmetrical front, the new architecture offered a non-standard plan, commonly asymmetrical, which was shaped by the new nature of family life. The exterior became a logical outgrowth of the interior. As James and Katherine Ford state, “The prevalent phrase of ‘form follows function’ thus connotes the abandonment of ‘style’ for the logical three dimensional expression of family individuality.”¹¹⁷ These innovations of modern residential architecture were made on the basis of recognizing two central facts, as James and Katherine Ford wrote: (1) modes of living had changed radically such that (2) equivalent changes in house planning were needed.

One of the more successful attempts of modern architecture to develop a house capable of meeting the needs of the United States in the mid-century period and beyond—a house that would

---

meet the standards of the postwar housing mandate—was initiated by *California Arts and Architecture*. The magazine sponsored a project called Case Study Houses with the intention of engaging young architects in designing and building prototype, or case study, homes that would provide solutions to the postwar housing issue.\(^{118}\) The magazine commissioned major architects of the day, including Richard Neutra, Raphael Soriano, Craig Ellwood, Charles and Ray Eames, Pierre Koenig, and Eero Saarinen, to design and build inexpensive and efficient model homes to meet the residential housing needs that had arisen in the US at the end of World War II with the return of millions of soldiers. By 1948, the first six houses had been built, after which the program ran in an irregular fashion until 1966.\(^{119}\)

In general, and in comparison to the architecture of previous periods, modern architecture sought substance instead of style, simplicity instead of ornament, and spatial volume instead of building mass. House designs were not about a standard plan and façade anymore. Instead, they were about proficient expansion. Further, as James and Katherine Blake state, modern architecture was not about “fitting the family to the house but the house to the family.”\(^{120}\)

**The American Dream and Post–World War II Housing**

Although its meaning has changed over time, the American Dream refers to the ideal whereby a government protects individuals’ opportunities to pursue their own ideas of happiness—an ideal that is protected by the Declaration of Independence.\(^{121}\) The American Dream is generally understood as including both a global vision and personal considerations,

---


\(^{120}\) Ford, *The Modern House in America*, 11.

\(^{121}\) The Declaration of Independence includes this statement: “We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness.”
such as home ownership and upward mobility. However, in the mid-twentieth century, the
dream of home ownership and even better of owning a dream home became a significant
aspect of American culture, one that continues to endure in the present day. This dream of home
ownership was simultaneously a product and producer of postwar suburbanization.

The fact that in 1980, based on the census data, “more than 40 percent of the national
population, or more than 100 million people, lived in the suburbs” reveals the significance of
suburban life in the United States at this time.122 The term “suburb,” as Kenneth Jackson, the
American historian and social scientist, notes, is of course vague.123 However, scholars such as
Erma Bombeck describe it as a place characterized by homogeneity: “Suburbs are small,
controlled communities where for the most part everyone has the same living standards, the
same weeds, the same number of garbage cans, the same house plans, and the same level in
the septic tanks.”124

The story of sprawl and life in the suburbs is not limited to the second half of the
twentieth century in the US. The problems and challenges associated with suburbium were
already observable in Persia, ancient Rome, and medieval cities, and more recently in London
and other post-industrial Western cities. In its essence, suburbanity is sprawl, whether
suburban or exurban.125 As Robert Bruegmann notes, this phenomenon has been a feature of
cities from the beginning of urban history.126 However, the process of urban sprawl was more
rapid in American cities in the twentieth century than anywhere else. After World War II,
European countries were busy rebuilding their cities. However, in contrast, huge population
growth in the United States required rapid expansion in terms of infrastructure.127

122 Jackson, Crabgrass Frontier, 4.
123 Ibid.
124 Erma Bombeck, quoted in Jackson, Crabgrass Frontier, 4.
125 Jackson, Crabgrass Frontier, 4.
126 Bruegmann, Sprawl.
127 Ibid.
After the stock market crash of 1929 and the Great Depression of the 1930s, the United States tried to rebuild its economy. The 1939–1940 New York World’s Fair, the second largest American world’s fair ever, was an effort in support of this purpose. 128 From the opening slogan of “Dawn of a New Day” to the promise that visitors could take a look at “the world of tomorrow,” the New York World’s Fair was committed to showing Americans that the United States was recovering from the depression.

Meanwhile, American housing reformers of the period, led by Catherine Bauer, were pushing the government to amend the National Housing Act of 1934, which had created the Federal Housing Administration (FHA). Bauer drafted much of the legislation of the ensuing Housing Act of 1937 and served as a director of the United States Housing Authority (USHA), which was created through that act. A main provision of the Housing Act of 1937 was the requirement that the US government distribute funds to local public housing agencies with the purpose of improving the living conditions of low-income families. 129

The USHA was included as a body within the United States Department of the Interior as part of the New Deal, a series of economic programs created via legislation passed by Congress during President Franklin D. Roosevelt’s first term (1933 to 1936). A liberal response to the Great Depression, the New Deal focused on the “3 Rs”: relief, recovery, and reform, 130 and in 1933 the Home Owners Loan Corporation (HOLC) was established as a result. 131 Although Roosevelt’s New Deal called for direct action to mitigate the dramatically negative results of the depression era, the country did not recover from the depression until the start of World War II. 132

131 Hayden, Building Suburbia.
132 Jackson, Crabgrass Frontier.
To the average person in the United States (and elsewhere), the most important consequences of the end of World War II were not related to the end of a shortage of goods but to the survival of family members. Through sixteen years of depression and war, the construction industry had been dormant such that housing was the most pressing need of the postwar period. At the end of the war and as a response to the needs of the returning veterans, the Servicemen’s Readjustment Act of 1944, also known as the GI Bill, was passed to extend a wide variety of benefits to veterans. The VA loan (Veteran Affairs) guarantee program was created as an outcome of this bill. Backed by the FHA and the VA, banks provided loans to construct ten million homes between 1946 and 1953, thus creating a gigantic private housing industry.133

One of the largest and most successful projects of the time was Levittown, NY. As Barbara M. Kelly notes, although much has been written about the housing policies of the Depression and the postwar period, much less has been written of the houses built as a result of these policies.134 “There is a process though which a house becomes a ‘home,’”135 and Levittown was one of the places that achieved the purpose of providing houses that did indeed, become, real “homes” for people. In 1947, with the help of the GI Bill, Levitt & Sons started the development of 2,000 rental units for World War II veterans and their families, and ultimately built more than 140,000 houses, thereby turning “a cottage industry into a major manufacturing process.”136

According to American architect and urban historian, Dolores Hayden, “Backroom politics of the 1920s, 1930s, and early 1940s had shaped postwar housing and urban design.”137 The postwar suburbs were constructed at great speed, “but they were deliberately

---

133 Hayden, Building Suburbia.
135 Ibid., 11.
136 Jackson, Crabgrass Frontier, 234.
137 Hayden, Building Suburbia, 128.
planned to maximize consumption of mass produced goods and [to] minimize the responsibility of the developers to create public space and public services.”\textsuperscript{138}

In 1956, President Eisenhower’s Federal Aid Highway Act facilitated the construction of a new highway system, which, in turn, accelerated urban sprawl and suburbanization, especially around large metropolitan areas. Although governmental agencies claimed that one of the main motivations underlying this act related to national defense, scholars such as Dolores Hayden and Helen Levitt have argued instead that this act was part of a “planned sprawl” that presaged the rise of the mall.\textsuperscript{139} The automobile industry was also involved: At the New York World’s Fair of 1939, for example, General Motors’ “Futurama” exhibition offered up an image of the future in which traffic moved at 100 miles per hour on broad, elevated freeways and expressways. The idea of more cars on the roads and the promise of a national roadway system “attracted a diverse group of lobbyists, including the Automobile Manufacturers Association, [the] state-highway administration, motor-bus operators, the American Trucking Association, and even the American Parking Association.”\textsuperscript{140} In \textit{Crabgrass Frontier: The Suburbanization of the United States}, Jackson notes that the developments pertaining to transportation are not a “sufficient explanation for the initial development of the suburban trend.”\textsuperscript{141} However, studies by Jackson in conjunction with research by other scholars on issues related to suburbanization, for example Hayden’s \textit{Building Suburbia: Green Fields and Urban Growth, 1820–2000}, focus on transportation, thereby highlighting the expansion of suburban life in the postwar era and its dependency on the transportation revolution taking

\textsuperscript{138} Ibid., 128.
\textsuperscript{139} Helen Levitt, \textit{Superhighway-Superhoax} (New York: Ballantine Books, 1971); and Hayden, \textit{Building Suburbia}.
\textsuperscript{140} Jackson, \textit{Crabgrass Frontier}, 248.
\textsuperscript{141} Ibid., 42.
place.\textsuperscript{142}

Although it was difficult for middle-class people to afford a house in the downtown areas of cities, the housing industry advertised a suburban life as a place for “affordable homes for the common man.”\textsuperscript{143} Even from the end of the nineteenth century, because mass transit changed the shape of the suburbs, a “Why pay rent?” campaign was mounted to advocate for investing in home ownership. The widespread availability of automobiles in the postwar era made it easier for middle-class people to join this campaign, own a dream home, and show their social status. However, the notion of social importance as resting on home ownership was not a twentieth-century invention. According to Gwendolyn Wright, for centuries Americans have seen domestic architecture as an expression of social status, family stability, and a good society, and they have been “quite self-conscious about where they live and where their fellow citizens live as well.”\textsuperscript{144} Walt Whitman quoted by Kenneth Jackson put the case more simply: “A man is not a whole and complete man unless he owns a house and the ground it stands on.”\textsuperscript{145} The idea of owning land as “a mark of status,” as Jackson argues, was brought into the New World as part of the “cultural baggage” of the European settlers.\textsuperscript{146}

As a result of suburban life, and at the same time as a force for it, single-family houses became a stage for middle-class consumption, which became the route to economic prosperity. This view was shared not only by historians and other scholars, but also by developers, and manufacturers. This is what Lizabeth Cohen defined as the “Consumers’ Republic.” In the post–World War II period, especially in the large metropolitan areas,

\textsuperscript{142} In the 1950s, automobile culture had a significant influence on the culture of the United States. By the end of the war, industry had changed from producing wartime goods to consumer goods and automobiles played an important role. By the end of the 1950s, seventeen percent of American workers were working in the automobile industry. More suburban homes, more highways, more malls, more travel to the peripheral areas of cities meant more cars for consumers. And, more middle-class workers with cars meant more peripheral living (Dolores Hayden, \textit{Building Suburbia}).

\textsuperscript{143} Jackson, \textit{Crabgrass Frontier}, 116.


\textsuperscript{145} Jackson, \textit{Crabgrass Frontier}, 50.

\textsuperscript{146} Ibid., 53.
while cities grew by only 0.1 percent, the suburbs grew by an explosive 40 percent, which meant a new consumers’ market in suburban areas. Suburbanization gave a majority of Americans the opportunity to become people “of property” for the first time ever. The dream of home ownership for the middle classes was to become a reality. However, the dream was only about a single-family house and a yard. That is, at first, at least, Americans idealized the house and yard rather than the ideal town or neighborhood. The characteristics of suburban towns, especially in the postwar period, also showed a focus on this dream: low density, architectural similarity (monotony and repetition), easy availability, and most importantly, economic and racial homogeneity.

Architectural similarity, a characteristic of the postwar suburbs, was caused by mass customization and resulted in boring suburban neighborhoods, whereas individualistic middle-class people were looking for architectural diversity and innovation. As Kenneth Jackson has pointed out, scholars such as Gwendolyn Wright and Lewis Mumford viewed the new postwar suburb as a caricature of both the historic city and the archetypal suburban refuge: a multitude of uniform houses on uniform roads, at uniform distances inhabited by people of the same class, with the same income, and in the same age group. Additionally, racial homogeneity, another characteristic of the postwar suburbs, meant racial segregation. This notion of sorting families based on race and income had started even before the civil war and was stimulated by the growth of the factory system.

More importantly, suburban life lacked community activities. According to Annmarie Adams, the mass movement of young Americans to the suburbs in the 1950s and early 1960s

---

148 Ibid.
149 Jackson, *Crabgrass Frontier*, and Hayden, *Building Suburbia*.
150 Howard Preston reported that “By 1930, if racism could be measured in miles and minutes, blacks and whites were more segregated in the city of Atlanta than ever before” (Jackson, *Crabgrass Frontier*, 241). A pattern that was evident throughout the country. Kenneth Jackson, however, argues that many pre-1930 suburbs “maintained an exclusive image despite the presence of low-income or minority groups living in slums near or within the community” (Ibid).
separated women in the suburbs from political, social, and financial power, thereby limiting their opportunities for employment, education, and cooperative parenting. In a sense, the American dream of home ownership created places of depression and desperation for women.\textsuperscript{151} Further, in terms of the planning of each house in the suburban neighborhood, there was a disconnection between community/neighborhood life and family life in the suburbs. For example, as Adams notes, in the postwar suburban development known as Eichler Homes, built in the postwar period in California, “family life was directed to the back of the lot.”\textsuperscript{152} Developed by Joseph Eichler, these are considered the most successful examples of modern architecture for the mass postwar market.

Architects, socialists, historians, planners, activists, and many others discussed issues related to suburban life, especially those related to women, as occupying the center of suburban living. As a result, the role of women as catalysts for creativity in modern houses was revealed and highlighted. Given the traditional connection between women and “the domestic realm,” “housework, home economics, and theories of domestic reform” were important factors in shaping a dream home such that the role of women became a significant consideration in the design of houses in the twentieth century.\textsuperscript{153}

In the mid-twentieth century, in addition to an understanding of the role of women as a catalyst for creativity in the home, the idea of privacy changed single-family suburban houses, in terms of both interior planning and the relationship between interior and exterior space. Modern architects such as Frank Lloyd Wright advocated for connecting the interior with the exterior. Yet, in general, suburban houses were disconnected from the neighborhood. For

\textsuperscript{151} Not all suburbs were depressing for women. Annmarie Adams in “The Eichler Home” argues that there were events and places within some suburbs that women could go to in order to socialize. As an example, she references the community pool in the Eichler development as a place mothers could talk and expand their social activities, while children played and took swimming lessons.\textsuperscript{152} Annmarie Adams, “The Eichler Home: Intention and Experience in Postwar Suburbia,” \textit{Perspectives in Vernacular Architecture 5, Gender, Class, and Shelter} (1995): 168.\textsuperscript{153} Ibid., 16.
example, in the Eichler developments, similar to many other developments, “The opacity of [the] front and sides of the house, the enclosed courtyard, and the high fence around the yard ensured that family life was focused within the property lines of the suburban home.”154

However, within the family home, the emphasis was on openness: the kitchen became the central part of the house, open to the living room, which itself was open to the dining area. This living center suggested an emphasis on motherhood in the design of the house in the Baby Boom era: Mothers “could, while preparing dinner, keep visual control of [their] children’s activities over the house.”155 Additionally, because of the small footprint of the houses, designers and developers worked to “throw together visually as much space as possible” in order to create the sense of a larger space.156 Although not connected to the neighborhood in front, with a large area of glazing, the backyard could act as an extension of the family room by making it visually larger and by providing a place for children to play. Another important feature of this open space in the center of the house was related to the idea of women acting not only as mothers, but also as the spouses of successful husbands. The promotional material for the Eichler developments, as Adams explains, suggested that the overall plan of the Eichler house cast the woman of the house in her “anticipated role as the hostess of cocktail parties for her husband’s business associates.”157 In houses with a larger footprint, an additional “family room” as an informal space for casual living became a necessity.158 American Builder in 1955 declared that “Without it [a family room] the builder will find himself behind his competition.”159

Other features of a typical suburban house, including the kitchen appliances or fixtures, were also designed or at least advertised in relation to maternal power or small children. For example, a kitchen faucet that could be controlled with one hand, radiant-heated flooring that

154 Ibid., 168.
155 Ibid., 168.
156 Ibid., 168.
157 Ibid., 170.
was safe for children to walk on barefoot, or wall paneling that was both durable and easy to clean. As Adams argues, these can be seen as an attempt to professionalize women’s position as homemakers, “in order to give their work a social value measurable in the same terms by which all labor was measured.” Furthermore, undecorated surfaces, sharp edges, and an open plan, all features of modern houses, were advertised as the foundation of easy housekeeping, as middle-class families no longer had servants.

There were several problems associated with suburbanization and suburban housing, some of which are noted in this study. However, the single-family suburban house as a mid-twentieth-century typology was accepted by the majority of Americans. It is unarguable that as a realization of the American Dream, suburban life and suburban houses as a package were advertised well enough as to be accepted by the majority of Americans. In Crabgrass Frontier, Kenneth Jackson had predicted that at the end of the twentieth century people of the United States would turn away from suburbia. Instead, Americans settled at a distance from metropolitan regions faster than ever before. In the late twentieth century, the simple dream of owning a house and its yard, especially for women, expanded into a dream of owning a house in the context of neighborhood sociability. The result was a triple dream: house plus land plus community. The physical realization of this dream was in the hands of developers trying to make a profit through suburban growth. Suburbs simply became the new cities.

Dream or reality, good or bad, successful or unsuccessful, suburbanization is a significant part of American history, especially from the mid-twentieth century onwards, shaping the single-family residential architecture of the country. The interior planning of many of the houses in which we live today, whether those built in the mid-century suburban

---

style or those built in other styles later, are influenced to some extent by the notion of achieving the American Dream. Given this background, the American dream of home ownership should be and to some extent has been explored via a dynamic relationship between a family, the domestic space its members occupy, and the context (preferably a sustainable and healthy environment) in which they live and socialize.

Shape Grammar

As a computational design methodology, shape grammar has been used to analyze the work of a given architect or a specific style since the 1970s. However, the present study focuses on the use of shape grammar as a way to analytically compare designs and define architectural hybridity. Defined as a set of rules of transformation applied recursively to an initial form in order to generate new forms, the idea of shape grammar formalism was introduced by Stiny and Gips in 1972 and further developed by Stiny (1980) and Knight (1983). In other words, a shape grammar is a rule-based system for analyzing, describing, and generating visual or spatial designs. Shape grammar began as a concept, with early applications focused on fine arts (1989), decorative arts (1977), architecture (1978), and eventually design (1998), including urban design (2011). Figure 2-1 shows the application domain of the shape grammar method since

---

163 Early examples of the use of shape grammar: in fine arts, Terry Knight’s “Transformations of De Stijl Art” (1989); in decorative arts, Knight’s “Generation of Hepplewhite-Style Chair-Back Designs” (1983) and Stiny’s “Ice-Ray: A Note on the Generation of Chinese Lattice Designs” (1977); in architecture, Stiny and Mitchell’s “Palladian Grammar” (1978) and Koning and Elizenberg’s “Language of the Prairie” (1981); in design, Agarwal and Cagan’s “Blend of Different Tastes: The Language of Coffeemakers” (1998), Shea and Cagan’s “Language and Semantics of Grammatical Discrete Structures” (1999), and Costa and Duarte’s “Tableware Shape Grammar” (2013); and in urban design, Beirão and Duarte’s “Towards a Methodology for Flexible Urban Design” (2011), and Mendes, Beirão, and Duarte’s “A Bottom-up Social Housing System Described with Shape Grammar” (2013).
the concept was introduced in the early 1970s. Figure 2-2, on the other hand, shows the computation of a simple shape rule.

Figure 2-1: Bubble chart of the application domain of the shape grammar method. Image from S. Garcia (2016).

Figure 2-2: Example of a shape grammar and the computation of a rule.

---

In general, a shape grammar is used for one or more of three reasons: (1) to describe or analyze a design, (2) to produce a design or a series of designs, and (3) to determine the design group to which a given design belongs. However, the shape grammar concept can also be used effectively to study design principles used in the past with the purpose of using them in contemporary design and likewise to adapt earlier designs for modern purposes. This purpose, which is more or less connected to the idea of hybridity, will be explored in the present study. The concept of shape grammar can also be used to redefine and extend a contemporary design. Dutch architect, educator, and theorist, N. John Habraken makes a case for adaptations of this nature as follows:

When we want to connect to our cultural tradition we must study in depth the building types this tradition maintained for many centuries. We must study them, not in the way historians would do, but from a designer’s point of view. We want to understand the design principles behind the building type to decide how we can use them today. Our goal is not to copy but to transform what was done in the past into something compatible with the values we hold today. We want to learn from our cultural heritage, not to deny present day realities, but to establish a continuity between tradition and renewal.\(^\text{165}\)

Habraken is a relatively well-known figure in the field of “user participation in mass housing,” which can be seen as a theory behind “mass customization,” a significant application for which the shape grammar concept has been used.\(^\text{166}\) In Habraken’s account, building types are described in relation to three systems: (1) the spatial and functional system, (2) the structural and building system, and (3) the stylistic and decorative system.\(^\text{167}\) The present study relies on the same building systems in an analysis of the architectural language of the domestic architecture of the focal architect. Similar to Habraken’s three systems, the shape grammar concept can be applied to and/or described according to three distinct though closely related aspects: (1) spatial and functional, (2) structural/building technology/materials, and (3) stylistic and decorative. In

\(^{167}\) These systems are, in turn, based on Vitruvius’s three elements of architecture: Firmness, Commodity, and Delight.
order to use the shape grammar concept effectively, however, an additional spatial, functional, technological, and stylistic analysis is required to describe the various rules of the grammars.

**Analytical Shape Grammar**

As stated, Stiny and Gips defined the concept of shape grammar as a set of rules of transformation applied recursively to an initial form in order to generate new forms. There are two main shape grammar categories: original shape grammar (syntactic shape grammar) and analytical shape grammar. Analytical grammars are used to “analyze historical styles or languages of design by architects no longer living,” whereas original grammars are used to create new and original designs.\(^{168}\) Traditionally, there has been a separation between analytical grammars and grammars for new design styles. However, in “Customizing Mass Housing: Toward a Formalized Approach” Duarte demonstrated that the two are, in fact, linked.\(^{169}\) He argues that analytical grammars can be used to decode historical precedents and grammatical transformations to encode “synthetic” grammars. Although creating a synthetic grammar is beyond its scope, the present study does engage with exactly that idea in pursuit of the goal of putting hybridization into a wider context of designing from precedents. The focus of this section, however, is on the analytical shape grammar given that in the present study, shape grammar is used principally as an analytical rather than as a generative tool.

The shape grammar concept has been used as a powerful tool to analyze the architecture of the past, both for historical reasons and to produce new designs based on the predominant design principles of earlier periods. Accordingly, in his article “More Than the Sum of Parts: The

---


Grammar of Queen Anne Houses,” Ulrich Flemming described how he used the shape grammar concept to analyze his subject and the challenges encountered and the benefits gained in doing so:

In the process of developing the grammars we were forced to look at examples with a degree of closeness that is hardly necessary if the analysis proceeds in the traditional, intuitive way. In particular, we were forced to deal with [the] overall aspects of plan organization, massing, and articulation that are usually neglected in style descriptions or are described in less precise terms. As a result, we were able to demonstrate how the various parts and features of a house relate to each other and to explain its overall geometry, given the premises of the picturesque aesthetic.\footnote{Ulrich Flemming, “More Than the Sum of Parts: The Grammar of Queen Anne Houses,” \textit{Environment and Planning B: Planning and Design} 14 (1987), 349.}

In terms of analyzing architectural examples, the first significant work is the shape grammar of Frank Lloyd Wright’s Prairie Houses created by H. Koning and J. Elizenberg. The researchers studied a corpus of Wright’s houses in this genre and analyzed the spatial relationships they express. And, on this basis, they created an “additive” shape grammar for Wright’s Prairie Houses capable of producing not only the houses originally designed by Wright, but also new designs based on his Prairie style (Figure 2-3).\footnote{H. Koning and J. Elizenberg, “The Language of the Prairie: Frank Lloyd Wright’s Prairie Houses,” \textit{Environment and Planning B} 8 (1981), 295–323.}
Koning and Elizenberg’s work is significant not only because they revealed unrecognized aspects of Wright’s Prairie Houses, but also because of the methodology they used in that
endeavor. They formed the grammar and then tested it by generating new designs that are difficult, if not impossible, to distinguish from Wright’s work.

In the 1980s, Terry Knight further developed the shape grammar concept with her idea of “Transformation in Design” in which she used a “formalism for describing stylistic change in design” to analyze how Georges Vantongerloo and Fritz Glarner had drawn on and transformed the De Stijl style of painting in their own work” (Figures 2-4 and 2-5). Her strategy is used in the present study to analyze different stages of Hajjar’s single-family architecture in State College.

Figure 2-4: Vantongerloo’s paintings representing six of the seven groups of his paintings. Image from Knight (1989).

---

Figure 2-5: A derivation of a design in the language generated by the stage I grammar created by Knight (1989).
Further developing and using the same strategy of transformation in design, Knight transformed the grammar of Wright’s Prairie Houses, developed earlier by Koning and Elizenberg (1981), to form the grammar of Wright’s Usonian Houses (Figure 2-6).\textsuperscript{173} The notion of style and stylistic change, which are central issues in the study of art and architecture, are addressed in Knight’s studies on transformation in design, particularly in her book, \textit{Transformations in Design: A Formal Approach to Stylistic Change and Innovation in the Visual Arts}, where the grammar of Usonian Houses was published.

Figure 2-6: Basic composition rules used by Knight (1994) to transform the Prairie House grammar into the Usonian House grammar.

By drawing on the idea of grammatical transformation and merging multiple grammars, Scott Chase and Sumbul Ahmad (2005) presented a methodology of “composite grammars” to use in analyzing hybrid designs. Jose P. Duarte made an important contribution to extending the shape grammar concept by using it in the context of mass customization. He also worked with a team on a project titled “Digital Alberti,” in which the central idea was to use computational methodologies to determine the impact of Alberti’s treatise on Portugal’s classical and modern architecture. Although an underlying influence of Alberti’s theories is evident in Portuguese classical architecture, the extent of this influence could not be determined with conventional historical methodologies. As part of the project, Bruno Figueiredo, Luis Sousa, Jose P. Duarte, and Mario Kruger developed a research study based on these theoretical foundations to translate the *De re aedificatoria* (1485) proportional descriptions of sacred architecture into a “description grammar” (defined by Stiny in 1981) and a shape grammar, which they used to determine Alberti’s influence on Portuguese Renaissance architecture. The process relied on using shape grammar transformations as a computational framework to determine Alberti’s influence on Portuguese Renaissance churches (Figure 2-7). In their research, shape grammars are “proposed as a complementary tool to be used by architectural historians to test [a] hypothesis raised after documental evidence.”

---

175 For more information, refer to http://albertidigital.ces.uc.pt.
Unlike a typical grammar, which focuses on a specific design language, a generic grammar “is a formalism that allows the design of diverse solutions.” This idea was developed by Deborah Benrós and her advisors, Sean Hanna and Jose P. Duarte, with the purpose of forming a generic housing grammar that would include rules from the Palladian Villas, Wright’s Prairie Houses, and Siza’s Malagueira Houses. The methodology is based on three processes: “the development of generic shape rules, the creation of a generic grammar formalism and lastly the development of specific parameterization to represent different languages.” With this methodology, Benrós

---


proposed a “generic housing process based on a parametric shape grammar,” which she used “to investigate relationships between several grammars of families of designs.” It is important to note that to form a generic grammar based on a comparison of the three existing grammars, the latter should all have been created in the same way. For example, in this case, a set of shape rules obey the principles of addition, subdivision, concatenation, subtraction, or replacement.

In drawing on the idea of grammatical transformation, the present study follows in the footsteps of all the studies noted above. However, in the present study, shape grammars are developed and compared to determine the ways in which they influenced one another, thereby advancing shape grammar as a computational design methodology.

Chapter 3

Adapting Modern Architecture to a Local Context: A Grammar for Hajjar’s Hybrid Domestic Architecture

Introduction

The residential architecture of A. William Hajjar, a faculty member at Penn State and a practitioner in the area in the mid-twentieth century, as noted in the Introduction, incorporates many of the shapes, rules, and features of both European modern architecture and American traditional architecture. In this regard, his work reflects a quality that may be unique to certain architects in certain situations, in this case, to faculty-practitioners producing residential architecture in small American college towns in the mid-century. In relation to this architectural hybridity, this chapter draws on computational design methodologies to investigate Hajjar’s architecture. In particular, the chapter offers information needed to identify Hajjar’s single-family architectural language and verify and describe this hybridity phenomenon. This chapter focuses on describing Hajjar’s single-family architecture by developing a grammar of his work. The rules Hajjar followed in designing single-family houses are identified and described, and the ways in which these rules are applied in derivations of houses he designed are identified and described likewise. In addition, solutions generated by the grammar other than the houses he designed are also identified and described as a point of comparison.

This study, and particularly this chapter, owes a debt to the work of other authors. In 1983, taking the transformation of Frank Lloyd Wright’s Prairie Houses into Usonian Houses as her focal case, Knight showed how stylistic evolution in art and design can be explained by the evolution of the underlying grammars. In 2001, Çolakoğlu used this idea to propose a methodology to design contemporary houses from vernacular Turkish Hayat houses. Four years later, Chase and Ahmad used grammatical transformations to explore hybridity in design. Then,
in 2011, Eloy and Duarte proposed the transformation grammar concept as a way to adapt an existing house type to the needs of contemporary life. In the same year, Kruger et al. (2011) advocated the use of transformations to study Alberti’s influence on Portuguese classical architecture. More recently, Benrós (2018) used transformations in design to study the phenomenon of hybridity in architectural languages. Against this background, the present chapter is principally concerned with developing a shape grammar for Hajjar’s architecture as the initial step. However, the ultimate purpose, which is pursued in later chapters, is to contrast Hajjar’s grammar with the grammars of American traditional architecture and European modern architecture.

Preliminary Work

To achieve the stated objectives, the present research comprises a two-level study: a study at a relatively broad scale to search for and analyze buildings designed by faculty-practitioners who designed houses built in college towns in the mid-twentieth century, and a study at a more detailed scale to thoroughly analyze the architecture designed by Hajjar for State College, where Penn State’s University Park campus is located. For the preliminary broader-scale study, all the college towns that hosted NAAB-accredited architecture degree programs prior to 1940 were identified (Table 3-1). The year 1940 was chosen, as it was at this point in time that the first group of US architecture students who had graduated from programs run by members of the European avant-garde had the opportunity to start teaching and practicing.
Table 3-1: College Towns with Accredited Architecture Programs in 1940, Sorted by State, with Population and Enrollment Data from 2016

<table>
<thead>
<tr>
<th>City</th>
<th>State</th>
<th>Type</th>
<th>School</th>
<th>est.</th>
<th>Arch</th>
<th>Pop</th>
<th>Enrollment%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auburn</td>
<td>Alabama</td>
<td>Land grant</td>
<td>Auburn U</td>
<td>1856</td>
<td>1907</td>
<td>42,987</td>
<td>21,860</td>
</tr>
<tr>
<td>Gainesville</td>
<td>Florida</td>
<td>Flagship</td>
<td>U of Florida</td>
<td>1853</td>
<td>1925</td>
<td>95,447</td>
<td>45,114</td>
</tr>
<tr>
<td>Moscow</td>
<td>Idaho</td>
<td>Flagship</td>
<td>U of Idaho</td>
<td>1890</td>
<td>1923</td>
<td>21,291</td>
<td>11,633</td>
</tr>
<tr>
<td>Champaign-Urbana</td>
<td>Illinois</td>
<td>Flagship</td>
<td>U of Illinois</td>
<td>1867</td>
<td>1968</td>
<td>103,913</td>
<td>38,465</td>
</tr>
<tr>
<td>Ames</td>
<td>Iowa</td>
<td>Land grant</td>
<td>Iowa State U</td>
<td>1858</td>
<td>1914</td>
<td>50,731</td>
<td>26,845</td>
</tr>
<tr>
<td>Manhattan</td>
<td>Kansas</td>
<td>Land grant</td>
<td>Kansas State U</td>
<td>1858</td>
<td>1903</td>
<td>44,631</td>
<td>21,929</td>
</tr>
<tr>
<td>Lawrence</td>
<td>Kansas</td>
<td>Flagship</td>
<td>U of Kansas</td>
<td>1864</td>
<td>1913</td>
<td>80,098</td>
<td>25,920</td>
</tr>
<tr>
<td>Ann Arbor</td>
<td>Michigan</td>
<td>Flagship</td>
<td>U of Michigan</td>
<td>1837</td>
<td>1873</td>
<td>114,024</td>
<td>38,103</td>
</tr>
<tr>
<td>Bozeman</td>
<td>Montana</td>
<td>Land grant</td>
<td>Montana State U</td>
<td>1893</td>
<td>1913</td>
<td>27,509</td>
<td>11,666</td>
</tr>
<tr>
<td>Princeton</td>
<td>New Jersey</td>
<td>Private</td>
<td>Princeton U</td>
<td>1746</td>
<td>1919</td>
<td>14,203</td>
<td>6,547</td>
</tr>
<tr>
<td>Ithaca</td>
<td>New York</td>
<td>Private-Land grant</td>
<td>Cornell U+ IC</td>
<td>1865</td>
<td>1871</td>
<td>29,287</td>
<td>26,296</td>
</tr>
<tr>
<td>Oxford</td>
<td>Ohio</td>
<td>Flagship</td>
<td>Miami U</td>
<td>1809</td>
<td>1929</td>
<td>21,943</td>
<td>16,757</td>
</tr>
<tr>
<td>Stillwater</td>
<td>Oklahoma</td>
<td>Land grant</td>
<td>Oklahoma State U</td>
<td>1890</td>
<td>1909</td>
<td>39,065</td>
<td>18,676</td>
</tr>
<tr>
<td>Norman</td>
<td>Oklahoma</td>
<td>Flagship</td>
<td>U of Oklahoma</td>
<td>1890</td>
<td>1926</td>
<td>59,694</td>
<td>24,205</td>
</tr>
<tr>
<td>State College</td>
<td>Pennsylvania</td>
<td>Flagship</td>
<td>Penn State U</td>
<td>1855</td>
<td>1910</td>
<td>38,420</td>
<td>40,571</td>
</tr>
<tr>
<td>Clemson</td>
<td>South Carolina</td>
<td>Land grant</td>
<td>Clemson U</td>
<td>1889</td>
<td>1914</td>
<td>11,939</td>
<td>17,465</td>
</tr>
<tr>
<td>Prairie View</td>
<td>Texas</td>
<td>HBCU</td>
<td>Prairie View A&amp;M U</td>
<td>1876</td>
<td>1920</td>
<td>4,410</td>
<td>6,609</td>
</tr>
<tr>
<td>College Station</td>
<td>Texas</td>
<td>Land grant</td>
<td>Texas A&amp;M U</td>
<td>1876</td>
<td>1905</td>
<td>67,890</td>
<td>44,026</td>
</tr>
<tr>
<td>Blacksburg</td>
<td>Virginia</td>
<td>Land grant</td>
<td>Virginia Tech</td>
<td>1872</td>
<td>1928</td>
<td>39,573</td>
<td>27,869</td>
</tr>
<tr>
<td>Charlottesville</td>
<td>Virginia</td>
<td>Flagship</td>
<td>U of Virginia</td>
<td>1819</td>
<td>1919</td>
<td>45,049</td>
<td>22,411</td>
</tr>
<tr>
<td>Pullman</td>
<td>Washington</td>
<td>Land grant</td>
<td>Washington State U</td>
<td>1890</td>
<td>1911</td>
<td>24,675</td>
<td>20,492</td>
</tr>
</tbody>
</table>

Next, a search was conducted to find faculty members in those college towns who had also practiced architecture locally (Appendix A). Then, from that group, faculty who had designed non-traditional-style single-family houses were identified. As stated in Chapter 1, although numerous faculty members practiced architecture locally in the mid-twentieth century, only six of them had trained both according to the principles of modern architecture, either directly or indirectly, with one of the European émigrés architects/teachers in the late 1930s and early 1940s and practiced locally in a non-traditional style in the post-WWII era in their respective college towns (Table 1-3). These six faculty-practitioners graduated from one of the seven “less conventional” architecture schools of the mid-twentieth-century United States. As noted briefly in Chapter 2, Anthony Alofsin explains that in addition to Harvard’s Graduate School of Design (GSD) and Chicago’s Armour Institute—considered to be the most prominent schools in the nation in terms of training students in modernist architecture—“several less

---

181 This term refers to houses in styles that are not colonial, revival, Victorian, or eclectic (Beaux Arts), ranch, or split level. The notion refers to architecture that was relatively new to the area. It might be called modern but is not necessarily considered modern architecture as defined by Hitchcock and Johnson.
conventional schools also appeared” in that period: The Institute of Design in Chicago (later merged with IIT), Black Mountain College (a design school rather than an architecture program), Frank Lloyd Wright’s Taliesin, MIT, and the Georgia Institute of Technology. As stated in Chapter 1 (Table 1-3), the six faculty-practitioners mentioned above taught and practiced in five US college towns: Ann Arbor, MI; Blacksburg, VA; College Station, TX; Gainesville, FL; and State College, PA.

As noted in Chapter 1, Hajjar’s single-family architecture in State College, Pennsylvania, was chosen as the focal work of a faculty member for the present study for two reasons: because of the easy access to his work around the Penn State campus and because Hajjar designed and built more homes than did any of the other five faculty members. For these reasons, his role in the local history of architecture is significant.

It is also important to note that based on the author’s architectural intuition and the preliminary analysis, the hybridity in Hajjar’s architecture can be effectively described in his interior layouts and the volumetric relationship in houses he designed in the area. Many previous studies and stylistic analyses by other scholars, many of which are cited in the present research, describe architectural languages in a 3-dimensional format by developing 3-D grammars. Yet, in the present study, the focus is floor plans and the relationship between the volumes and interior layouts.

Adaptations of Modern Architecture

In the first stages of the research for the present study, Fernando Lara’s methodology in his account of Brazilian adaptations of modern architecture, or what he calls “popular modernist
architecture,” was followed. Lara defined the main features of traditional versus modern residential architecture in Brazil and assigned each element of the house’s façade a value as a basis for determining whether the building should be regarded as more modern or more traditional in nature. Lara analyzed Brazilian modernism through “interviews with inhabitants of popular modernist homes and an examination of the buildings’ façade and floor plans.”

For the present study, after a list of single-family homes designed by Hajjar, the selected focal faculty member, had been compiled, a physical inventory of each house was prepared. Most of this information was gathered through archival research. However, in order to obtain photographs of the façades and to prepare the physical inventory, a site visit was also necessary. A data collection form was prepared for the purpose of collecting information during these visits (Fig. 3-1). Based on the information from the archival research and the physical inventory, a simplified plan and elevation diagrams (Fig. 3-2) were produced for each house, which proved useful for analyzing the architecture including in comparing European modern (Fig. 3-3) with American traditional architecture.

An analysis of these physical inventories provided a foundation for characterizing Hajjar’s architecture and studying the spatial relationships in the houses he designed in order to create a shape grammar of his work. This shape grammar was then compared with grammars of both American traditional architecture and modern European architecture in order to identify similarities and differences between them.

---

184 From the six college towns, information was compiled for College Station, TX, State College, PA, Ann Arbor, MI, Virginia Tech, VA, but not yet for Gainesville, FL.
Figure 3-1: A data collection form completed for a Hajjar design in State College, Pennsylvania.
William Hajjar at Penn State

Abraham William Hajjar was a faculty member and researcher in architecture at the Pennsylvania State University in the mid-twentieth century and a practitioner in the local town of State College. Known professionally as A. William Hajjar and as “Bill” to his friends, he was born on February 11, 1917, in Lawrence, MA, to an immigrant Lebanese family, the youngest of eight children (Fig. 3-4). In 1936, he left the family’s grocery store business to study architecture at the Carnegie Institute of Technology (now Carnegie Mellon), from which he received his professional Bachelor of Architecture degree in 1940. A year later, he received a master’s degree from MIT in the same subject. Hajjar joined the Department of Architecture at the State College of Washington in 1942. However, in 1946, he moved to State College to join the architecture faculty at the Pennsylvania State College, now Pennsylvania State University, commonly known as Penn State. He then focused on securing tenure for a number of years. However, having
succeeded in securing tenure, in the following period of 1952 to 1963, Hajjar was to design and build thirty-three single-family houses in the Penn State area. In 1952, the first house he designed for State College was built in the area (Fig. 3-5), followed by thirty-two more in the ensuing years. However, his move to Philadelphia in 1963 on a leave of absence from Penn State to work with Vince King, a friend from MIT and a successful Philadelphia architect, signaled an end to his single-family residential work in the State College area.

Figure 3-4: William Hajjar (top right) with his seven siblings at a family reunion near Boston in 1956. Image from the Hajjar family collection.

In the late 1930s, Hajjar was a student at Carnegie, which like most of the architecture programs in the country, was dominated by the Beaux-Arts. As Hajjar’s son, Mark, notes, at Carnegie, the students were doing ink drawings with washes of classic Greek columns, and as a result, Hajjar became interested in this genre such that he produced examples of this style during this period and for a few years afterwards.\textsuperscript{185} However, he also came into contact with some of the young faculty members teaching freshman and sophomore studios who favored a modernist

\textsuperscript{185} Mark Hajjar, telephone conversation with the author, August 2016.
design philosophy. In addition, and perhaps, critically, Walter Gropius, who had moved to the United States to direct the architecture program at Harvard, delivered a lecture at Carnegie in 1938, during Hajjar’s sophomore year. This was probably Hajjar’s first opportunity to interact with Gropius, although we do not know if the two actually met at this time.

While at MIT, Hajjar became well-versed in modernist design under the supervision of Lawrence Anderson, who was among a number of faculty members advocating for modern architecture at MIT during the 1930s. In 1939, with his office partner and fellow faculty member Herbert Beckwith, Anderson completed the MIT Alumni Pool Building, one of the first modernist buildings on an American campus (Fig. 3-5). The building included an innovative glass design, which was probably responsible for Hajjar’s interest in double-layer glass architecture early in his career.\textsuperscript{186} Anderson endeavored to bring a modern outlook to MIT’s program in the late 1930s. He also advocated for Alvaro Aalto’s appointment as a research professor in architecture at the school in 1940. Although he did not teach a studio course at MIT while Hajjar was a student there, Aalto did lecture at MIT during that time and played a role “in guiding the students” to develop research” related to the problems assigned to them.\textsuperscript{187} More importantly, it is likely that Hajjar was influenced by modernist ideas propagated by the German émigrés: He was at MIT when Gropius and Breuer were at Harvard, a time when students from the two schools attended lectures together and when Anderson would often invite Gropius, Breuer, and other outside critics to MIT to review the students’ work.\textsuperscript{188} 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 together and collaborated on a project. There, Hajjar and Ieoh Ming Pei (known as I. M. Pei),

\textsuperscript{186} In the late 1950s and early 1960s, Hajjar conducted extensive research on a double-skin façade concept, which he called the “Air-Wall,” and designed and built a test building at Penn State, a four-sided double-layer glass-wall structure.

\textsuperscript{187} President’s Report, Massachusetts Institute of Technology, October 1940, 131.

\textsuperscript{188} Oral history interview with Lawrence Anderson, 1992.
Gropius’s student at the time, worked together and over time became friends. Later, Pei visited Penn State at Hajjar’s invitation to speak with the latter’s students. These collaborations between MIT and Harvard introduced not only Hajjar, but also his fellow students, including William W. Caudill, to Gropius’s architectural philosophy. Other well-known architects who were students at MIT under Anderson’s supervision at the same time include Vincent Kling, Gordon Bunshaft, George Nakashima, I. M. Pei, Bill Hartmann, and Clarence Y. Yokomoto. Kling eventually established a large practice in Philadelphia where Hajjar worked as a senior designer during a leave of absence from Penn State in the mid-1960s.

Figure 3-5: MIT Alumni Pool (1939) designed by Lawrence Anderson and Herbert Beckwith. Image from *The Filtration System for the New M.I.T. Swimming Pool*. 190

---

189 I. M. Pei was an MIT undergraduate student who received his B.Arch. degree in 1940 and then pursued his graduate work at Harvard under Gropius.

Hajjar's Architecture

When Hajjar moved to State College, most single-family residences in the area were in the Georgian revival, colonial revival, Tudor, and Cape Cod styles (Table 3-2), although ranch and split-level houses were also starting to appear. In 1946, when he first moved to State College with his family to teach at Penn State, Hajjar initially bought a traditional two-story Georgian revival house close to campus (Fig. 3-6). In addition to Hajjar, other faculty members at Penn State were also practicing in the area, including Philip Hallock, Kenneth Heidrich, and Cuth and Christine (Chris) Salmon. Heidrich, who was trained at Carnegie Tech (1930) and Princeton (MFA, 1937), was designing traditional-style houses in the 1940s. However, in the 1950s, he became a follower of Frank Lloyd Wright and started designing Wright-inspired houses. Table 3-2 shows a list of registered architects in the Borough of State College in the mid-twentieth-century period.

Table 3-2: Registered Architects in the Borough of State College, Pennsylvania, in the Mid-twentieth Century

<table>
<thead>
<tr>
<th>Architect</th>
<th>Lifespan (if known)</th>
<th>Primary style(s) (if known)</th>
<th>Other information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percy Ash</td>
<td>1885–1933</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frederick Charles Disque</td>
<td>Worked in Early 20th century</td>
<td>Georgian/colonial revival</td>
<td></td>
</tr>
<tr>
<td>Laurence Kocher</td>
<td>1885–1969</td>
<td>Colonial revival, worked with Disque</td>
<td></td>
</tr>
<tr>
<td>John Robert Bracken</td>
<td>1891–1979</td>
<td></td>
<td>Head, Department of Landscape Architecture at Penn State</td>
</tr>
<tr>
<td>Dean Elwood Kennedy</td>
<td>1902–1980</td>
<td>Tudor revival, later contemporary-modern</td>
<td></td>
</tr>
<tr>
<td>Paul Boyd Kapp</td>
<td>1908–1977</td>
<td>Tudor revival/colonial revival</td>
<td>Worked with Kennedy</td>
</tr>
<tr>
<td>Clarence M. Bauchspies</td>
<td>1906–1993</td>
<td>Tudor, Georgian/colonial</td>
<td></td>
</tr>
<tr>
<td>Harry Ohmit Smith</td>
<td>Worked in 1930s</td>
<td>Cape Cod, English revival, Spanish revival</td>
<td></td>
</tr>
<tr>
<td>Kenneth Heidrich</td>
<td>1907–1981</td>
<td>Became Wrightian in the 1950s</td>
<td>Faculty member at Penn State</td>
</tr>
<tr>
<td>William Hajjar</td>
<td>1917–2000</td>
<td>College town modernism</td>
<td>Faculty member at Penn State</td>
</tr>
<tr>
<td>Raniero Corbelletti</td>
<td>1922–1988</td>
<td>Modern-eclectic</td>
<td>Head, Department of Architecture at Penn State</td>
</tr>
</tbody>
</table>
Hajjar’s first design in State College was his own family home in College Heights, an area adjacent to the university. Based on Borough of State College documents, a building permit was issued for Hajjar’s house in 1951 to be built on Mitchell Avenue. However, for reasons that are not known, it was built a year later on Westview Avenue (Fig. 3-7).

Figure 3-6: Hajjar’s first single-family house, which he lived in with his family in State College, Pennsylvania, at 1157 S. Atherton Street.

Figure 3-7 (a&b): Hajjar House I, built in 1951 (left). A simple diagram of the house façade in its current situation. The blue lines show an addition built above the breezeway (right).

191 Index to Historical Building and Zoning, Borough of State College.
The two-story house consisted of a simple shoebox and a garage connected to the main house via a breezeway (the second story above the connection part is a later addition) (Fig. 3-8). With cement blocks for the base and wood cladding for the top part together with a sloped roof, Hajjar’s first design in the neighborhood is similar in some ways to other houses in the area. However, there is no front porch and no entrance in the front façade. In fact, the front façade seems to be a side façade in comparison to the appearance of other houses in the area. Most of the colonial revival houses nearby have a garage at the back of the building. Hajjar rotated the organization of the house so that the garage has become part of the front façade with the main entrances hidden in the side and through the breezeway.

![Diagram](image)

Figure 3-8: Diagram (produced by author) showing Hajjar’s first project in State College, Pennsylvania: the garage (gray) is connected through a breezeway (green) to the main house.

The building served both as a family residence and as Hajjar’s office. He built an office with three desks, where his students would come to work on his projects. Later (C. 1958), he built an office on South Atherton Street, approximately a mile away from the campus in a commercial setting, where Hajjar and Wall Associates was established (Fig. 3-9). Harlan Wall was Hajjar’s student at Penn State and then an employee of his practice who eventually became his partner. Louis Inserra, who later became a faculty member at Penn State practicing architecture in the late twentieth century, was also a student and employee of Hajjar’s.
While at Penn State, Hajjar designed and built thirty-three single-family residential buildings in the area (Figure 3-10 and Appendix B). His initial work in the State College area was mainly in the College Heights neighborhood situated immediately northwest of the Penn State
campus and in the Holmes Foster neighborhood situated to the southwest of campus. Some of the houses he designed in these neighborhoods, especially the earliest houses, consist of what Robert Malcom referred to as a core “shoe box” design element (Fig. 3-11). The shoe box could be long or short, parallel or perpendicular to the main road, but most had a low-pitched roof that could be symmetrical or asymmetrical.

![Diagram of a Hajjar residential design with a core shoe box.](image)

Figure 3-11: Diagram of a Hajjar residential design with a core shoe box.

Most have a garage, usually with a flat roof, connected to the main house with a breezeway, although by now many of the breezeways have been altered to accommodate an enclosed addition (Fig. 3-12). Most of the time, the main entrance of the house is through this breezeway. In fact, the entrances to Hajjar’s houses are generally hidden, either through the breezeway or at the side.

---

192 The College Heights neighborhood includes “old” College Heights, which is a registered historic district mainly north of campus, east of Atherton Street. Hajjar’s buildings, however, are located in the “new” College Heights neighborhood, which is the western addition of the historic district and located on the eastern side of Atherton Street.
193 Robert E. Malcom, a faculty member at Penn State, collected images (with captions) for an exhibit for the Centre County Historical Society, which is now also available as part of the Penn State University Libraries Digital Collection.
The feature whereby a garage is connected to the main house was not invented by Hajjar. With the popularity of automobiles in the mid-century, most of the houses had garages. Houses that were built in the area at the same time had garages as well, although these tended to be situated at the back of the house. Although built during the same general time frame, Frank Lloyd Wright’s Usonian Houses had carports instead of garages in order to keep construction costs down. However, unlike American traditional houses in the area, Hajjar generally designed the garages with flat roofs connected through the breezeway to the house. Both garages and breezeways were significant features of the façades Hajjar designed. In the 1920s, Le Corbusier had designed his Villa Savoye paying extra attention to the need to accommodate automobiles. Similarly, understanding the significance of automobiles in the twentieth century, Hajjar designed garages not as an addition to the back of the house like traditional houses in the area, but as a main part of the façade.

As noted, the orientation of this main house-breezeway-garage arrangement varied from house to house: some houses were parallel to the main street and some perpendicular. The roofs also differed slightly from each other: some were front-gabled and some side-gabled, but in either case, they were low-pitched although a few houses had an inverted roof (butterfly roof). In some cases, a pitched roof covered the breezeway area and sometimes the garage to make extra space on the second floor. This is a trick that some residents have used to alter their houses in order to
gain a second floor on top of the breezeway. Together, the breezeway and garage made a wing for the main house. In some cases, Hajjar designed the house with two wings, a longer one with a garage and a shorter one without a garage (Fig. 3-13).

![Diagram of main house with two wings designed by Hajjar.](image)

The College Heights neighborhood is slightly but characteristically hilly. Further, some of the lots are relatively small. It is worth noting that the houses Hajjar designed for and built in the neighborhood take advantage of the hilly topography and maximize the potential of the small lots by situating the entryway and any extensions (wings) halfway between the upper and lower levels, i.e., the Eakin Residence (Figs. 3-14 and 3-15). This can be read as an adaptation of the mid-century split-level effect. However, although in section and in façade, there are similarities between Hajjar’s architecture and mid-century split-level houses, in terms of the interior planning, the design, the organization of the fenestrations, and the slope of the roof, there are differences. For example, Hajjar’s interior planning leans more towards a modernist idea of an open plan, especially in the public part of the house (living room-dining room-kitchen). Specifically, typical mid-century split-level houses were still built with the living room facing the street, whereas Hajjar’s designs were open with the kitchen facing the street and the living room at the back of the house with large openings between the various functional areas of the house.
In the plans, the entryways to Hajjar’s houses are generally in the middle open space, which could include a hall and a family/sitting room or area. Hajjar was interested in the placement of windows: his houses often featured window walls opposite the entryway (on both levels). Figure 3-16 shows a reproduction and edited version of a diagram by Robert Malcom showing the room arrangement of Hajjar’s classic design. This arrangement can be read as a modern plan 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 used in the Georgian period and the Georgian revival period as a developed hall-parlor organization or as a developed four-square design (Figure 3-17). For example, Figure 3-17 (a), shows the plan for George Mason’s Gunston Hall, a great example of a
traditional house built in a Georgian architecture style. There were (still are) many neo-Georgian (Georgian revival) and four-square houses in the College Heights neighborhood with similar plans that may have had an influence on Hajjar’s residential architecture. It is worth noting on this point that Hajjar grew up in a brick house with a similar plan in Massachusetts. These similarities will be explored in greater detail in subsequent chapters in which Hajjar’s grammar is compared with the grammar for traditional houses in the area.

Figure 3-16: Reproduction of Robert Malcom’s diagram showing the room arrangement of Hajjar’s classic design.

---

194 Constructed between 1755 and 1759 near the Potomac River in Mason Neck, Virginia, Gunston Hall was the home of the United States founding father George Mason (Gunston Hall Official website: gunstonhall.org).
Similar to Malcom’s diagram, the diagrams in Figure 3-18 represent an interpretation of Hajjar’s classic house based on his drawings for various projects.

Figure 3-17 (a, b, and c): Gunson Hall, Lorton, VA, example of a Georgian villa plan as it appeared in the early twentieth century, prior to restoration (left); a typical American four-square plan (catalogue house) (center); and the second floor of a developed four-square plan (right).

Figure 3-18: Diagrams of Hajjar’s classic house. Garage connected to the main house through the breezeway (left) and a second floor with four bedrooms (right).
Although based on the schematic plans shown above, which is similar to the hall-parlor organization or four-square house plan, Hajjar’s interior seems conventional, the interior planning is quite modern. In general, instead of a hallway—common in traditional layouts—Hajjar’s plans have an open central space, which resulted in a spacious and open-plan feeling in the interior. As shown in Figure 3-18, and as described by Malcom, on the bedroom level, a large sitting area/family space generally separated the two sleeping areas. Various ceiling heights in a single house was another mid-century effect that he used, similar to Wrightian architecture. Also, similar to Wright, Hajjar liked to include a dominant fireplace in the family/sitting area. This was another difference between Hajjar’s design and that of the traditional houses in the neighborhood. Many of the traditional houses in the area originally had their chimney/fireplace at one end of the house. Understanding the nature of Pennsylvania weather, however, Hajjar designed the fireplace as a central element in most of his plans.

Figure 3-19: Reproduction of Hajjar’s design for a “New Residence” on Cherry Hill Road, State College, Pennsylvania. From top left to bottom right: conceptual design, lower floor, main floor, and upper floor plans.
Most of Hajjar’s single-family houses in the area feature a low-sloped roof. However, the Gemmell Residence is one of his houses that features a flat roof (Figure 3-20 and Figure 3-21). Built in 1957, the house for Mr. and Mrs. Gemmell reflected ideas from modern architecture, such as a flat roof and a very large window, along with a screened porch, which is known as an American traditional feature—a feature also used in Gropius House designed by Gropius and Breuer in the late 1930s.

Figure 3-20: Hajjar’s rendering for the Gemmell Residence, State College, Pennsylvania, 1957.

The three-part design is still evident in the Gemmell Residence: The porch is connected to the main part by a connector that not only includes a staircase but also the main living room with a fireplace. The main volume is a double-story square plan, which reflects traditional planning.

Figure 3-21: Diagram (produced by author) showing the façade of the Gemmell Residence, State College, Pennsylvania, 1957.
A Grammar for Hajjar’s Single-Family Houses in State College

Developing a shape grammar of Hajjar’s single-family residential architecture in State College is an important part of this research. In order to do so, information related to all thirty-three houses designed and built in the area by Hajjar was collected for the present study. In addition, the spatial relationships in his designs were studied as a foundation for developing the shape rules. Appendix B shows a list of houses Hajjar designed in the area with information related to each of them. As a sample of the research data, Table 3-3 lists the first five houses designed and built in the area by Hajjar together with representative information collected.

Through a consideration of the volumetric relationship, the spatial organization, and the main features of Hajjar’s single-family houses in the area, five subtypes in his plans were identified (Fig 3-22): (A) 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; (B) split-level organization, where the sleeping area is a half floor above the living area; (C) butterfly organization, where a cross-shape or U-shape plan prevails; (D) compact organization, where a square-shaped plan reflects Hajjar’s idea of a core area; and (E) linear organization, where two square-shaped plans form a rectangular/linear plan.

---

Table 3-3: The First Five Single-Family Houses Designed by William Hajjar in State College, Pennsylvania. Note that North is up.

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Original owner(s)</th>
<th>Original owner's occupation</th>
<th>Construction</th>
<th>Orientation</th>
<th>Main floor area</th>
<th>Const. date</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hajjar I House</td>
<td>520 Westview Ave</td>
<td>William and Anne Bortz Hajjar</td>
<td>William was an architect and professor of architecture; Anne did not have a profession outside the home</td>
<td>Balloon frame on top of a CMU base</td>
<td>1,020 SF (W/O the garage and breezeway)</td>
<td>1952</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lowenfeld House</td>
<td>728 Franklin Street</td>
<td>Viktor and Gretta Lowenfeld</td>
<td>Viktor was the head of the Dept. of Art Education; Gretta did not have a profession outside the home</td>
<td>Wood siding</td>
<td>1,890 SF (W/O the indoor open connection, W/O garage and yard and porch)</td>
<td>1954</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metzger House</td>
<td>555 Hillcrest Ave</td>
<td>Fred, Helen, and Laura W. Metzger</td>
<td>Fred was a well-known businessman in town</td>
<td>Wood siding</td>
<td>1,623 SF (W/O porch and attached garage)</td>
<td>1954</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eisenstein House</td>
<td>931 Robin Rd</td>
<td>Julian and Elizabeth Lewisohn Eisenstein</td>
<td>Julian was a scientist; Elizabeth was an art collector</td>
<td>Wood siding</td>
<td>3,324 SF (W/O porch)</td>
<td>1954, altered significantly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mebane House</td>
<td>942 Robin Rd</td>
<td>Tom S. and Barbara Mebane</td>
<td>Tom was a medical doctor; Barbara did not have a profession outside the home</td>
<td>Wood siding</td>
<td>1,882 SF (W/O the porch)</td>
<td>1954</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
As explained in relation to Hajjar’s first design in the area (Fig. 3-8), a signature feature is evident in the relationship between the main volume, the garage, and the breezeway. Figure 3-23 shows the spatial organization of a Hajjar house with the special relationship between the three main parts.
In most of the subtypes with a rectangular shape plan, in the inhabitable volume, the main living floor is usually divided into six rectangles (almost squares) of various sizes (Fig. 3-24). The public space, which is the living room (similar to Figure 3-23) and sometimes a formal dining room, generally consists of two of the smaller rectangles at one end of the plan whereas the space at the other end of the plan is dedicated to more private use. The two central rectangles form a connector between the public and private parts of the plan and include transitional spaces, stairs, sometimes a formal dining room, and sometimes a kitchen or bathroom. The divisions of the main rectangular floor plan into six smaller spaces/rooms are very similar for the one-level organization as for the split-level organization, the latter of which has two volumes: one with one story and another with two stories (usually with the garage at the lower level). However, the
spatial organization differs quite a bit. In the split-level case, the private part of the house is on the upper level of the two-story volume and the public parts are situated in the one-story volume (Fig. 3-25). For the compact organization, the square-shape plan is divided into four parts with one or two passageways/transitional spaces to circulate between the functions. The main floor in this subtype still has an open plan organization and the transitional spaces are conceptual (Fig. 3-26).

Figure 3-24: Diagrams (produced by author) showing the main living floors of four houses designed by Hajjar located on Glenn Road, State College, PA, as a development project (1955–1956). The houses were not built for specific clients; instead the land was purchased, and buildings were built and sold in partnership with a local developer.
Figure 3-25: Diagrams (produced by author) showing the floor plan of the Held Residence, designed by Hajjar (1958), which has a split-level organization. Note that the main living area (which is divided into three parts) is dedicated to public functions whereas the spaces for private functions are located a half level higher up. Color representation: living room (green), dining room (brown), kitchen (purple), bathroom (blue), bedroom (red), circulation/hallway (orange), and staircase (yellow).

Figure 3-26: Diagrams (produced by author) showing the plans of the two main floors of the Herzog Residence (Osmond Street Project House #3). Note that the spatial organization reflects a square-shaped plan. Color representation: living room (green), kitchen (purple), bedroom (red), family sitting area (brown), bathroom (blue), circulation/hallway (orange), and staircase (yellow).
Figures 3-27, 3-28, 3-29, and 3-30 show the spatial organization of houses designed by Hajjar in the area that were used to infer the grammar.

Figure 3-27: Spatial organization of houses designed by Hajjar in the State College, Pennsylvania, area: subtype A.

Figure 3-28: Spatial organization of houses designed by Hajjar in the State College, Pennsylvania, area: subtypes B and C.
Figure 3-29: Spatial organization of houses designed by Hajjar in the State College, Pennsylvania, area: subtypes B and C.

Figure 3-30: Spatial organization of houses designed by Hajjar in the State College, Pennsylvania, area: subtypes D and E.
In general, the grammar of the single-family houses designed by Hajjar in mid-twentieth-century State College was developed based on the five subtypes described. Further, the grammar encompasses four phases or groups of rules:

- Rules 1-2 capture the way in which Hajjar situated his houses on the lots (Figure 3-31).
- Rules 3-5 describe the formal relationships between mass volumes (Figure 3-31).
- Rules 6-31 describe the way in which the interior space is divided into smaller rooms or spaces and the way in which functions are allocated (Figures 3-32, 3-33, and 3-34).
- Rules 32-41 generate details such as wall thickness and the placement of closets (Figure 3-35).

Figure 3-31: Rules of the Hajjar grammar capturing how the houses are situated on the lots and the rules describing the formal relationship between the volumes.
Figure 3-32: Rules of the Hajjar grammar describing the way in which the interior space is divided into smaller rooms/spaces and the allocations of functions.
Figure 3-33: Rules of the Hajjar grammar describing the way in which the interior space is divided into smaller rooms/spaces and the allocations of functions.
**Figure 3-34:** Rules of the Hajjar grammar describing the way in which the interior space is divided into smaller rooms/spaces and the allocations of functions.

**Figure 3-35:** Rules of the Hajjar grammar describing the details generated, such as wall thickness and the placement of closets.
Figures 3-36 and 3-37 show derivations of designs in the corpus used to infer the grammar. In addition to all the houses designed by Hajjar included in the corpus, the grammar can generate Hajjar-inspired houses—i.e., solutions generated by the grammar that were not designed by Hajjar (Figure 3-38). To facilitate the generation of designs and eliminate human input in applying rules to generate houses, a computer program has been developed. The code was written in the Python scripting language for Rhino. Figure 3-39 shows examples of designs generated by this computer program.

Figure 3-36: Derivation of the Snowdon Residence, State College, Pennsylvania, designed by Hajjar in 1959. The rule numbers applied at each step are indicated above the arrow.
Figure 3-37: Derivation of the Eisenstein Residence, State College, Pennsylvania, designed by Hajjar in 1954.

Figure 3-38: Derivation of a design (not designed by the architect) generated by the Hajjar grammar.

Figure 3-39: From left to right: The Euwema Residence, Ferrell Residence, Christ-Janer Residence, and a Hajjar-inspired house, all generated by the computer program based on the Hajjar grammar.
Discussion

It is important to note that the grammar developed for Hajjar’s houses goes beyond the formal relationship of the spaces. It accounts for other aspects, such as cultural issues, issues related to privacy, construction limitations, building technology and many more. As an example, Figure 3-40, which represents a manually created variation tree (as opposed to computer-generated plans) of houses is based on three subtypes of Hajjar’s houses in the area. It shows houses designed by Hajjar, houses not designed by Hajjar but that could have been designed by him (generated by the grammar), and houses that could have been generated based on the functional organization of Hajjar’s houses but that do not accord with the notions of privacy expressed in Hajjar’s work such that he would never have designed them. The grammar is developed such that these latter designs are eliminated.

Figure 3-40: A variation tree of Hajjar’s houses based on subtypes A, B, and D. Note that the designs with a black rectangle around them are designs that Hajjar would never have designed; therefore, the grammar won’t generate them.
Studying the shape rules reveals that in addition to rules explaining Hajjar’s architectural ideas and his specific language, there are two distinct groups of rules, which are given here with examples:

- Rules basic to architecture and to the development of a plan:
  - Rules 1 and 2 (Figure 3-31) define the location of the building on the lot based on the building codes and/or zoning regulations relating to setbacks etc.
  - Rules 32 and 33 (Figure 3-35) define walls based on lines.

- Rules that show the architectural trends of the time influenced by the local context and/or changes to architecture in the US in the mid-twentieth century:
  - Rules 10 and 11 (a, b, and c) (Figure 3-42) show a separation between the public portion of the house and the private portion—which might be considered as constituting an essential move in domestic architecture, reflecting the influence of the modern architecture of Gropius and Breuer, and/or indicating the influence of the local context. However, this element shows a social change in relation to the domestic architecture of the United States in the mid-twentieth century: whereas in traditional American architecture, the living room was in the front of the house facing the street and the kitchen was situated in the back facing the back yard, the “modern” trend in the mid-century was the opposite configuration.

An important question in comparing shape grammars pertains to the level of detail needed. This question can be answered by identifying where hybridity exists, whether in the functional organization, the building system, and/or in the decoration, following Habraken’s definition of house type as a concept defined by these three subsystems. At this stage, Hajjar’s grammar is used to describe the spatial relationships in his interior layout and the volumetric relationships in his overall design, mainly because the preliminary analysis suggests that hybridity might be most important at this level. The next step is to determine the extent to which the rules of the respective grammars are similar or different. Based on a comparison of the rules of Hajjar’s grammar with those of other grammars, it will be possible to determine which rules have been retained, changed, deleted, or added, as proposed by Knight in her *Transformations in Design* to explain stylistic evolution in relation to grammatical transformations. As briefly

---

197 Terry Knight, *Transformations in Design: A Formal Approach to Stylistic Change and Innovation in the Visual Arts* (Cambridge:
discussed in Chapter 2, using the shape grammar methodology, Knight introduced an innovative approach to analyzing stylistic changes with a formal model. She used examples including the meander motif on Greek geometric pottery, the transformation of Frank Lloyd Wright’s Prairie Houses into his Usonian Houses, and especially the transformation of De Stijl’s art: By highlighting the way in which rules changed from one stage to another, she explained the stages and overall evolution of paintings by Georges Vantongerloo and Fritz Glarner (Figures 2-4 and 2-5). The same idea will be used in the present study to compare three architectural languages. Whereas Knight focused on transforming one grammar to find another grammar in order to explain the evolution of a specific architect or artist’s work, in the present study the rules of three distinct grammars are compared to determine which rules were retained, changed, deleted, or added to explain architectural hybridity. In this regard, it is important to note that the grammars must be developed in a way that enables comparison, as noted by Benrós in her comparison between the Palladian Villas, Wright’s houses, and Siza’s homes.198

Chapter 4

Bauhaus Internationalism to College Town Modernism: Exploring Bauhaus Culture in Hajjar’s Hybrid Architecture

Introduction

Whereas in Chapter 3, the architectural language of William Hajjar was analyzed by exploring his single-family houses in State College, Pennsylvania, in the mid-twentieth century, this chapter focuses on the architectural language of Walter Gropius (Gropius–Breuer partnership) as the founder of the Bauhaus architecture and a practitioner who was prominent in introducing European modernism to American architecture students in the same period. Similar to the previous chapter, this analysis is performed using shape grammars as a computational design methodology. The ultimate goal is to analyze Hajjar’s single-family architecture in comparison with the European modernist work of Gropius and Breuer in the United States.

As explained in more detail in Chapter 4, as the work of a faculty-practitioner Hajjar’s single-family homes in the State College area may be unique to a certain kind of 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 period. Many such faculty members practicing 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. These schools included the Illinois Institute of Technology (IIT), the Massachusetts Institute of Technology (MIT), and Harvard’s Graduate School of Design (GSD). In particular, the GSD led the way in championing the new European style and eventually became the nation’s preeminent school in relation to training students in modernist architecture. With the appointment of Walter
Gropius as director of Harvard’s Department of Architecture, the process of introducing American students to European modernism had officially begun.

As noted in Chapter 2, with the exceptions of Harvard and the Armour Institute of Chicago (later known as IIT), the latter of which was led by Mies van der Rohe from 1938 to 1959, most US architecture programs remained under the Beaux-Arts system of education (or variations) 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.

Although 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. As noted in Chapter 3, among these 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 in the United States to promote modernism.199 As Alofsin commented, Anderson, “a longtime bastion of the French approach,” was “instrumental in bringing in modernist thinking.”200 Hired by MIT in 1933, Anderson 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 towards 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.201

Similar to Chapter 3, this chapter as part of the overall study follows in the footsteps of research studies published by several authors, noted previously: Knight’s idea of the transformation of grammars, Çolakoğlu’s methodology to design contemporary houses based on vernacular houses, Chase and Ahmad’s description of hybridity in design, Eloy and Duarte’s proposal to adapt existing house types to the needs of contemporary life, Kruger et al.’s use of the transformation grammar method to study Alberti’s influence on classical Portuguese architecture, and Benrós’s use of the idea of transformations in design to study hybridity in architectural languages. This chapter 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.

**Walter Gropius and the Bauhaus Culture**

“Creation and love of beauty are elemental for the experience of happiness. A time which does not recognize this basic truth does not become articulate in the visual sense; its image remains blurred; its manifestations fail to delight.”

**Early Life and Training**

Born on May 18, 1883, in Berlin, Walter Gropius is known as one of the “pioneers of [the] modern movement.” Growing up in a wealthy and well-connected family, with his uncle, Martin Gropius, an established architect and the designer of the Museum of Decorative Arts in Berlin (1881), Gropius was encouraged to develop an interest in architecture early in life. At the age of twenty, he enrolled in the Technical School in Munich and then the Koniglich Technische

---

Hochschule in Berlin to study architecture. However, just shy of finishing his program, Gropius dropped out of the Hochschule—a move that suggests early disagreement on his part with the traditional methods of architectural education.

In 1908, Gropius joined Peter Behrens’s office, where he worked on the innovative AEG Turbine Factory (Figure 4-1) and factories for the Krupp company. In this context, Gropius learned about the possibilities of using new materials and construction techniques, which he drew on in later years in many of his designs, including for mass housing projects and even the Bauhaus building in Dessau. In this environment, he came to know Mies and Le Corbusier, who were also based in Behrens’s office.

Figure 4-1: AEG Turbine Factory by Peter Behrens (1909). Image from Khan Academy.

In 1910, Gropius and Adolf Meyer, a colleague at Behrens’s practice, left their positions to set up an office in Berlin. They joined the Deutsche Werkbund (German Workers’ Federation)—“an association of designers and architects who promoted the integration of new
industrial mass production with traditional art and design.”

It was during this period that they worked on the façade of the Fagus Factory (Figure 4-2) in Alfeld-an-der-Leine, Germany, in addition to designing objects, furniture, and buildings (Figure 4-3). However, in 1914, with the outbreak of World War I, Gropius was drafted into the German army, such that their work was interrupted at that time.

Figure 4-2: The Fagus Factory in Alfeld-an-der-Leine, Lower Saxony, Germany. Image from Wikipedia.

Figure 4-3: Walter Gropius and Adolf Meyer, model factory (factory and office building), Werkbund exhibition, Cologne, 1914. Image from photobucket.com.

After the war, Gropius started sympathizing with the Left and advocating for the role that design and architecture could play in social reform. In 1919, he became master of the Grand Ducal Saxonian School of Arts and Crafts in Weimar, which he renamed Staatliches Bauhaus Weimar, the beginning of the famous Bauhaus school. As noted in Chapter 2, he gathered together a group of teachers, including Paul Klee, Josef and Anni Albers, Herbert Bayer, Laszlo Moholy-Nagy, and Wassily Kandinsky, to use art and architecture and workshop-based education to experiment with ways to help alleviate the problems of postwar society.

The Bauhaus was founded in Weimar in 1919, re-established in Dessau in 1926, and finally closed in Berlin in 1933. During its relatively short existence, the Bauhaus succeeded in offering a clearly defined alternative to “the state-sponsored fine arts academies that had flourished during the nineteenth century.” As Kathleen James-Chakraborty comments in Bauhaus Culture, the Bauhaus was the site of “the twentieth century’s most influential experiment in artistic education.” As scholars such as Wallis Miller have stated, reflecting the success of Gropius’s efforts to have the Bauhaus construct “the new building of the future,” the school has long been routinely referenced in discussions of modern architecture. It is important to realize that not only did Gropius and his successors, Hannes Meyer and Ludwig Mies van der Rohe, manage to “gather together well-known architects along with those who showed great promise,” but that Gropius in particular also managed to publicize the Bauhaus in such a way as to gain it an unassailable position in the history of architecture.

---

205 Kathleen James-Chakraborty, ed. Bauhaus Culture, From Weimar to the Cold War (Minneapolis and London: University of Minnesota Press, 2006), XI.
207 Wallis Miller, “Architecture, Building, and Bauhaus” in Bauhaus Culture 63.
Gropius and the Bauhaus Legacy in the United States

As noted in Chapter 2, 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 US, 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 of van der Rohe at IIT marked “the beginning of systematic training in modern principles in American architectural education.”

In Germany, Gropius had focused on large-scale buildings, such as apartment buildings and institutional projects. His only residential work in that country was the “Masters’ Houses,” a group of seven houses, two semi-detached and one detached, for the Bauhaus teachers, commissioned by the City of Dessau in 1925–1926 (Figure 4-4). It was not until his move to the US that Gropius turned his attention to designing single-family architecture. In 1937, with Breuer, he designed his first house, Gropius House, for his own family in Lincoln, MA, with the construction ending in 1938 (Figure 4-5). 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.

---

208 Jordy, The Aftermath of the Bauhaus in America, 486.
Numerous 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, and the Geller House in Lawrence, NY, is one of the first houses to reflect his idea of a binuclear house, with two wings—one for daytime activities and the other for nighttime activities—separated by an entry hall. Most of the houses designed by Breuer and/or 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.

**Gropius–Breuer Grammar**

Gropius commented that after moving to the United States and becoming well known, “I realized that I am a figure covered with labels, maybe to the point of obscurity.”²⁰⁹ He was referring to labels such as “Bauhaus Style,” “International Style,” and “Functional Style,” which as he noted “have almost succeeded in hiding the human core behind it all.” He was, therefore, eager “to put a few cracks into this dummy that busy people have slipped around” him.²¹⁰ It can be argued that the labels indicate that he was following a systematic design idea that can be translated to a pattern/grammar in his architectural language. The author’s own architectural intuition and historical analysis were the primary reasons for the decision to use shape grammars to analyze Gropius and Breuer’s architectural language and compare and contrast it with that of Hajjar. However, the posited systematic design idea was also a key factor in that decision.

²¹⁰ Ibid.
Similar to the process used to develop a grammar based on Hajjar’s projects in State College, all the single-family houses designed by Gropius and/or Breuer in the United States are analyzed in the present study with an emphasis on their volumetric relationships, spatial organization, and defining architectural features. Information related to all the houses designed by Gropius and Breuer either as individuals or in partnership was collected, and the spatial relationships expressed in their designs studied as a foundation for understanding the encoding of the shape rules identified. Examples of analyses of the spatial relationships of the houses Gropius and/or Breuer designed in the United States are shown in Figures 4-6 and 4-7.

Figure 4-6: Spatial analysis of Gropius House designed by the Gropius–Breuer partnership and built in 1938 in Lincoln, Massachusetts.
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 for Hajjar’s work. Generally, for grammars to be comparable, they should have been developed in the same way, including at the same level of detail. When this is the case, it is easiest to compare the grammars by determining the rules that have been borrowed, deleted, changed, or added (created).

Figures 4-8, 4-9, 4-10, and 4-11 show the rules of the grammar developed for Gropius and Breuer’s work in the United States. The grammar can produce both the early houses that the architects designed in a style that closely resembles the Bauhaus and the binuclear plans. Figures 4-12, 4-13, and 4-14 show step-by-step derivations of selected Gropius and Breuer houses in the United States, from which the grammar was inferred. In addition to its ability to generate all the houses designed by these two architects in the United States, the grammar can generate plans in the architectural language of the Gropius–Breuer partnership (Figure 4-15).
Figure 4-8: Rules of the Gropius–Breuer grammar: the relationship between volumes.
Figure 4-9: Rules of the Gropius–Breuer grammar: the interior space is divided into smaller spaces.
Figure 4-10: Rules of the Gropius–Breuer grammar: functions assigned to the interior spaces.
Figure 4-11: Rules of the Gropius–Breuer grammar: interior detailing.
Figure 4-12: Derivation of Robinson House designed by Breuer and built in 1946.

Figure 4-13: Derivation of Breuer House II designed by Breuer and built in 1947.
Figure 4-14: Derivation of Starkey House, also known as Alworth House, designed by Breuer and built in 1954.

Figure 4-15: Derivation of a design generated by the grammar for Gropius and Breuer’s work.
Grammar Comparison

As noted earlier, based on shape grammars, this chapter focuses on comparing Hajjar’s architecture in State College with single-family houses designed by Gropius and/or Breuer in the United States. In order to do this, it is necessary to compare and contrast the rules of the two grammars. Thus, the rules are divided into categories, i.e., volumetric organization, interior organization, and allocation of functions. Then, the rules of the Hajjar grammar are compared with the rules of the Gropius–Breuer grammar in each category to determine which rules are the same, which have been changed, which have not been used (deleted), and which are new in the Hajjar grammar (created) (Figures 4-16, 4-17, 4-18, and 4-19).
Figure 4-16: Comparison of selected rules of the grammars: the Hajjar grammar and the Gropius–Breuer grammar.
Figure 4-17: Comparison of selected rules of the grammars: the Hajjar grammar and the Gropius–Breuer grammar.
Figure 4-18: Comparison of selected rules of the grammars: the Hajjar grammar and the Gropius–Breuer grammar.
Figure 4-19: Comparison of selected rules of the grammars: the Hajjar grammar and the Gropius–Breuer grammar.
Two methods are used to test for similarities between the rules of the two grammars: (1) a step-by-step comparison between the derivation of a house designed by the Gropius–Breuer partnership and the derivation of a house by Hajjar, and (2) the production of a Gropius–Breuer house through the grammar of Hajjar’s work and a comparison between it and the original design. Figure 4-20 shows a comparison of a step-by-step derivation of the James Ford House designed by the Gropius–Breuer partnership and built in 1939 and the Higdon Residence, a similar house in terms of size, proportion, and geometry, designed by Hajjar and built in 1955. The Higdon Residence 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 of the house that projects out to expand the dining area is unique to the Gropius–Breuer design.
The same strategy is demonstrated through a comparison between Alworth House, a house with binuclear organization designed by Breuer and built in 1954 (Figure 4-21), and the...
Eakin Residence, a similar house in terms of size, proportion, and geometry, designed by Hajjar and built in 1955 (Figure 4-22). The specific rules and the number of rules applied from the two grammars differ across the steps. However, between the two derivations, the results of some of the steps are exactly the same or very similar, as shown with a red border in Figure 4-22. It is important to note that with this comparison, the author does not suggest that Hajjar’s Eakin House is directly influenced by 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 terms of the interior planning, spatial organization, separation of daytime and nighttime activities, and geometry and volumetric organization between the respective architectural languages of Hajjar and Gropius–Breuer. For instance, the two grammars have some rules in common, specifically those that add a secondary (private) inhabitable space with a connector to the initial inhabitable space and then divide the main rectangular inhabitable space into six smaller spaces/rooms and the main square inhabitable space into four smaller spaces/rooms. The results of these same rules can be seen in the second and third steps of the comparison shown in Figure 4-22.

Figure 4-21: The Alworth House designed by Breuer and built in 1954 (left) and the Eakin Residence designed by Hajjar and built in 1955 (right).
Figure 4-22: Comparison of a step-by-step derivation of the Alworth House designed by Breuer (left) and the Eakin Residence designed by Hajjar (right), organized in two columns. Note that in each step, different rules may apply in each derivation. The steps with similar results are highlighted with a red border.
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 modernist or traditional architecture. For example, as noted in Chapter 3, the living room at the back of the house facing the backyard and the kitchen facing 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.

Discussion

As noted earlier in this chapter, for ease of comparison, the rules of both grammars—the grammar for Hajjar’s work and the grammar for Gropius–Breuer’s work in the United States—are organized into descriptive categories. As the rule numbers in the two grammars do not match, categorizing the rules in the same way was necessary. There are eleven categories in total, consisting of finding the inhabitable space within the lot, dividing the main inhabitable space into smaller spaces or rooms, defining the garage space, defining private and public spaces, organizing spaces in a binuclear organization, defining the interior spaces or rooms, allocating functions to interior spaces/rooms, defining interior spaces such as bathrooms and stairs, defining the interior circulation, adding porches and/or balconies, and describing the interior detailing. Some of the categories have only two or three rules, whereas some others have up to ten rules.

From the fifty-one rules in the Hajjar grammar, thirty-one are the same as or very similar to rules in the Gropius–Breuer grammar. The similarity of the rules in some of the categories, particularly in relation to interior details and interior circulation, do not necessarily reflect the influence of Gropius and/or Breuer’s architecture on Hajjar’s work, as many of the rules in these categories would be the same or very similar in many architectural languages. There are also rules
based on decisions dictated by building codes or local zoning regulations in relation to, for example, the size of setbacks or the width of corridors. Other rules reflect the limitations of domestic building technologies such as the maximum span of ceiling joists. Neither do the similarities between these rules reflect the influence of Gropius and/or Breuer’s architecture on Hajjar’s. However, similarities between some of the rules in some of the categories do show the influence of Gropius and/or Breuer’s work in the US on Hajjar’s architectural language. For instance, the rules related to dividing the inhabitable space into smaller rooms or spaces and the rules related to organizing the volumes and the interior spaces in a binuclear way. Twenty-five percent of the rules in Hajjar’s grammar reflects the influence of Gropius and Breuer’s work in the United States on Hajjar’s architectural language.

In the context of the overall study, which was undertaken to analyze 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 European modernist and American traditional architecture, this chapter focused on comparing and contrasting Hajjar’s architectural language with the architectural language of Gropius and Breuer in the United States. The defining purpose of the present chapter as well as of the overall study 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 in architectural design. The use of shape grammars in identifying and describing hybridity in this regard and particularly in Hajjar’s architecture, will be explored in more detail in Chapter 6.

In relation to Hajjar’s architecture in the State College area, this part of the study highlights his contributions to the stability (and popularity) of modern architecture in central
Pennsylvania and, therefore, to some extent 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.
Chapter 5

Using Grammars to Understand Localized Modernism:
The Case of William Hajjar’s Single-Family Houses
in State College, Pennsylvania

Introduction

As discussed in Chapter 1, the present study began with the architectural observation that Hajjar’s residential architecture incorporates many of the features of both European modern architecture and American traditional architecture. This tendency to use elements from these two styles though a hallmark of Hajjar’s work, based on the preliminary study for the present research as discussed in Chapter 3, can also be found in the work of his fellow faculty practitioners in some other US college towns during the mid-century period. On this basis, Hajjar’s work and that of other faculty practitioners helped popularize modernism in the United States. In this chapter, Hajjar’s single-family architectural language is analyzed in relation to its specific local context—i.e., the traditional architecture of State College, Pennsylvania, a typical American college town. Through this approach, Hajjar’s architecture will be compared and contrasted with examples of American traditional architecture in State College.

In Chapter 4, Hajjar’s single-family architecture is described in comparison with European architecture and the Bauhaus style through the work of Gropius and Breuer in the United States, both of whom he met during his architectural studies. This comparison was performed by developing a grammar of Hajjar’s work in State College and comparing the rules identified with those of a grammar developed for the work of the Gropius–Breuer partnership in the United States. However, the focus of the current chapter is on comparing Hajjar’s architecture with the American traditional architecture of the context in which his work evolved. Through this comparison, the following questions will be explored: To what extent and in what ways is
Hajjar’s architecture traditional? And, to what extent can Hajjar’s architecture be generated by a traditional grammar? The chapter includes the rules of a grammar developed for traditional American houses in State College, a derivation of a traditional house in State College (very similar to the traditional house owned by Hajjar in the area), and a comparison of the rules of this grammar with the rules of the grammar developed for Hajjar’s architecture. Three ways to identify similarities between the rules of the two grammars are used: (1) the rules of Hajjar’s grammar are compared with the rules of the traditional grammar in order to determine which rules from the traditional grammar are retained, changed, or deleted in Hajjar’s grammar and which rules are new in the latter; (2) the derivations of houses—with similar layouts—generated by each of the grammars are compared step by step, and (3), a plan with a layout as close as possible to Hajjar’s architecture is produced with the grammar of traditional architecture and then compared with the original Hajjar-designed plan. The latter method of comparison will help us to understand the extent to which Hajjar’s architecture is traditional.

In the past three decades, using the shape grammar concept, several scholars studied the notion of stylistic evolution and introduced the idea of grammatical transformation. As discussed in the previous chapters, this scholarship includes Knight’s seminal work on the transformation of Wright’s Prairie Houses into Usonian Houses (1983), Çolakoğlu’s contemporary houses based on vernacular Turkish Hayat houses (2005), Chase and Ahmad’s account of hybridity in design (2005), Eloy and Duarte’s adaptation of existing house types to meet contemporary needs (2011), Kruger, Duarte, and Coutinho’s study of Alberti’s influence on classical Portuguese architecture (2011), and Benrös’s (2018) study of the phenomenon of hybridity in architectural languages. Extending the research cited, the present chapter is principally concerned with using shape grammar to describe the influence of traditional American architecture on Hajjar’s single-family architecture in the context of the central Pennsylvania college town of State College.
The College Town: An American Phenomenon

As explained in detail in Chapter 2, the college town as an American phenomenon is a community that is heavily dependent on the university it hosts. College towns have characteristics in common with both small towns and cities: In terms of population, urban settings and urban infrastructure, they are more comparable to other kinds of small towns. In terms of culture and education, they are more comparable to large cities.

Traditional American Architecture in State College, Pennsylvania

In A Field Guide to American Houses, Virginia and Lee McAlester designated houses found in typical American neighborhoods as either “folk houses” or “styled houses.” Most of the folk houses, also referred to as vernacular houses, were built by the first owners or other non-professional builders without any specific intention of following current fashion. However, as the researchers state, most American houses surviving from the nineteenth century are not folk houses but styled houses, which were built with “at least some attempt at being fashionable.” The styles described in their book comprise colonial houses (1600–1820), romantic houses or revival houses (1820–1880), Victorian houses (1860–1900), eclectic houses (1880–1940), and houses since 1940 (including contemporary and neo-eclectic). As noted, McAlester and McAlester based their stylistic approaches, descriptions, and style categories on domestic architecture found in typical American neighborhoods throughout the country. The present study, however, focuses on traditional American houses in State College, with the goal of uncovering their architectural influences and analyzing how the latter in relation to Hajjar’s mid-twentieth-century residential architecture.

Located in central Pennsylvania, State College is a college town dominated both economically and demographically by the University Park campus of Pennsylvania State University (Penn State). Evolving from a village to serve the needs of the Pennsylvania State College (founded as the Farmers’ High School of Pennsylvania in 1855), State College was incorporated as a borough in 1896. Expanding with the growth of the university, the neighborhoods adjacent to University Park campus initially developed in the early twentieth century. To study single-family domestic architecture designed in traditional styles in the area, it is instructive to explore the College Heights Historic District, a national historic district located north of campus that was added to the National Register of Historic Places in 1995.\footnote{212 “National Register Database and Research,” National Park Service, accessed on 2/10/2019, https://www.nps.gov/subjects/nationalregister/database-research.htm.} As stated in the National Park Service’s registration form, College Heights encompasses land and historic buildings associated with the early residential history of the town and “represents its growth and architectural development as an emerging college town.”\footnote{213 “National Register of Historic Places, College Heights Historic District, State College, Centre County, PA” nomination document, p. 2. National Park Service, https://www.nps.gov/subjects/nationalregister/database-research.htm.} Like all historic districts, College Heights has “contributing” and “non-contributing” properties. The registration form for College Heights indicates that the district has 278 contributing properties. Although all the contributing houses have a special characteristic(s) in relation to the history of the neighborhood, the registration document highlights some properties as the best examples of houses designed by local architects/contractors or offered by popular mail-order catalogues (Table 5-1). Most of these examples, constructed in the 1920s and 1930s, are built in bungalow, colonial (Dutch and Georgian), colonial revival, Georgian revival, and four-square styles. Figure 5-1 shows examples of the contributing houses in the district. Of these architectural styles, two interior plans are particularly popular in the neighborhood: a four-square organization and a four-room
organization with a hallway in the center, the latter, very similar to the house Hajjar first bought and lived in in the area. Figure 5-2 shows examples of each kind of interior organization.

Table 5-1: Examples of Traditional American Houses Designated as Contributing to the College Heights Historic District in State College, Pennsylvania

<table>
<thead>
<tr>
<th>Address</th>
<th>Style</th>
<th>Date</th>
<th>Architect</th>
</tr>
</thead>
<tbody>
<tr>
<td>214 Hartswick Ave</td>
<td>Craftsman bungalow</td>
<td>1920</td>
<td>Unknown</td>
</tr>
<tr>
<td>117 East Park Ave</td>
<td>Craftsman bungalow</td>
<td>1923</td>
<td>Unknown</td>
</tr>
<tr>
<td>326 West Ridge Ave</td>
<td>Dutch colonial</td>
<td>1920</td>
<td>Unknown</td>
</tr>
<tr>
<td>329 West Ridge Ave</td>
<td>Dutch colonial</td>
<td>1921</td>
<td>Unknown</td>
</tr>
<tr>
<td>722 Holmes Street</td>
<td>Georgian colonial</td>
<td>1935</td>
<td>Clarence M. Bauchspies</td>
</tr>
<tr>
<td>629 Sunset Road</td>
<td>Georgian colonial</td>
<td>c. 1935</td>
<td>Clarence M. Bauchspies</td>
</tr>
<tr>
<td>525 West Park Ave</td>
<td>English Tudor</td>
<td>1931</td>
<td>P. Boyd Kapp</td>
</tr>
<tr>
<td>525 McKee Street</td>
<td>Colonial revival</td>
<td>c. 1932</td>
<td>P. Boyd Kapp</td>
</tr>
<tr>
<td>172 Hartswick Ave</td>
<td>Mission style</td>
<td>c. 1921</td>
<td>Unknown</td>
</tr>
<tr>
<td>333 Arbor Way</td>
<td>Tudor</td>
<td>1935–1936</td>
<td>Kapp &amp; Kennedy</td>
</tr>
<tr>
<td>705 McKee Street</td>
<td>Colonial revival</td>
<td>c. 1931</td>
<td>Unknown</td>
</tr>
<tr>
<td>711 McKee Street</td>
<td>Colonial revival</td>
<td>c. 1931</td>
<td>Unknown</td>
</tr>
<tr>
<td>154 Ridge Ave</td>
<td>Tudor revival</td>
<td>1928</td>
<td>Frederick Disque</td>
</tr>
<tr>
<td>714 McKee Street</td>
<td>Colonial revival</td>
<td>1931</td>
<td>Walter Trainer</td>
</tr>
<tr>
<td>311, 317, 323, 327 East Park Ave</td>
<td>Colonial revival</td>
<td>c. 1933</td>
<td>Clarence M. Bauchspies</td>
</tr>
<tr>
<td>625 Holmes Street</td>
<td>Colonial revival</td>
<td>c. 1933</td>
<td>Clarence M. Bauchspies</td>
</tr>
<tr>
<td>721 Holmes Street</td>
<td>Tudor revival</td>
<td>1933</td>
<td>Clarence M. Bauchspies</td>
</tr>
<tr>
<td>608 Sunset Road</td>
<td>English Tudor</td>
<td>c. 1935</td>
<td>Clarence M. Bauchspies</td>
</tr>
<tr>
<td>629 Sunset Road</td>
<td>Georgian revival</td>
<td>1935</td>
<td>Clarence M. Bauchspies</td>
</tr>
<tr>
<td>346 Ridge Ave</td>
<td>Colonial revival</td>
<td>c. 1934</td>
<td>Clarence M. Bauchspies</td>
</tr>
<tr>
<td>615 N. Burrowses</td>
<td>Colonial revival</td>
<td>c. 1935</td>
<td>John Breneman</td>
</tr>
<tr>
<td>235 West Ridge</td>
<td>Tudor revival</td>
<td>c. 1935</td>
<td>John Breneman</td>
</tr>
<tr>
<td>705 N Holmes Street</td>
<td>Tudor revival</td>
<td>c. 1937</td>
<td>Carl Wild</td>
</tr>
<tr>
<td>426 W Ridge Ave</td>
<td>Tudor revival</td>
<td>c. 1935</td>
<td>John Frises</td>
</tr>
<tr>
<td>326 W Ridge Ave</td>
<td>Four-square</td>
<td>1920</td>
<td>Mail order</td>
</tr>
<tr>
<td>243 West Park Ave</td>
<td>Four-square</td>
<td>1925</td>
<td>Mail order</td>
</tr>
<tr>
<td>210 Hartswick Ave</td>
<td>Four-square</td>
<td>1929</td>
<td>Mail order</td>
</tr>
<tr>
<td>217 West Park Ave</td>
<td>Half-timbered</td>
<td>c. 1925</td>
<td>Mail order</td>
</tr>
<tr>
<td>214 Hartwick Ave</td>
<td>Bungalow</td>
<td>c. 1925</td>
<td>Mail order-Sears</td>
</tr>
<tr>
<td>143 West Park Ave</td>
<td>Bungalow</td>
<td>c. 1925</td>
<td>Sears Westly</td>
</tr>
<tr>
<td>520 Holmes Street</td>
<td>Bungalow</td>
<td>c. 1922</td>
<td>Sears Westly</td>
</tr>
<tr>
<td>215 Ridge Ave</td>
<td>Dutch colonial</td>
<td>1922</td>
<td>Arthur Cowell</td>
</tr>
<tr>
<td>433 Mitchell Ave</td>
<td>Tudor cottage</td>
<td>c. 1928</td>
<td>Unknown</td>
</tr>
<tr>
<td>747 Holmes Street</td>
<td>Cape Cod</td>
<td>c. 1938</td>
<td>Mail order</td>
</tr>
<tr>
<td>320 Hartswick Ave</td>
<td>Colonial revival</td>
<td>1932</td>
<td>Cont. Albert Bartges/Seas</td>
</tr>
</tbody>
</table>
Grammar for American Traditional Houses in State College, Pennsylvania

Although the grammar presented in this chapter is introduced as a grammar for American traditional houses, it is specifically a “generic grammar” for American traditional houses in the College Heights Historic District. As defined by Beirão and Duarte (2018), generic grammars are a set of production systems that are appropriate for four levels of use: as analytical, synthetic,
regulatory, and predictive tools. Based on this definition, generic grammars are commonly inferred from specific grammars developed using different corpora in the same design domain. Figure 5-3 is a conceptual diagram of the processes for developing and applying design systems, adapted from Duarte’s “Customizing Mass Housing.” In this diagram, Duarte explains that specific shape grammars inferred from specific designs can be generalized to produce a generic grammar that can then be used to produce new designs. Even though the grammar for American traditional houses described in the present chapter is not inferred from specific grammars developed for different styles of American traditional houses, such as colonial revival, four-square, bungalow, and Tudor, it is appropriate to call it a generic grammar, mainly because it is inferred from a corpus that itself consists of corpora of traditional American styles (Figure 5-4). The grammar is generic in terms of analyzing houses that differ stylistically from each other and in terms of implicitly encoding specific grammars corresponding to each given house style, which could be explicitly defined from the generic grammar. Further, the grammar is also regulatory and predictive—both of which are characteristics of generic grammars based on Beirão and Duarte’s definition.

---

216 Ibid.
Figure 5-3: Conceptual diagram of the processes for developing and applying design systems, adapted from Duarte’s “Customizing Mass Housing.”

Figure 5-4: Diagram showing the concept of a generic grammar inferred from specific grammars and/or inferred from a corpus consisting of different corpora within the same design domain.
The corpus of designs includes the house types referenced in the previous section (Table 5-1), meaning that the corpus consists of several traditional styles. Interior organization was the main feature considered in the process of analysis, with an emphasis on the two most popular interior plans in the area: the four-square and the four-room organization with a central hallway. Given the popularity of these plans, this emphasis is appropriate. However, there is also another key reason for this emphasis: this interior organization underlies most of Hajjar’s designs.

Additionally, as many of the houses in the district are bungalows, the grammar developed for this kind of house in Buffalo, New York, by Downing and Flemming in 1981 was also considered in the development of the grammar presented herein.\(^\text{217}\) Although Downing and Flemming developed their grammar for houses in Buffalo, as most of the houses in their corpus were catalogue homes similar to the bungalow houses in State College, it is appropriate to use their rules to develop a grammar for traditional houses in the State College area. A key reason for this decision is that many of the bungalow houses built in both cities were constructed during the same period (the 1920s) from the same design source (Sears).

As noted in the two previous chapters, only grammars developed with the same strategy, for example, additive or subtractive, can be compared accurately. Therefore, in some cases, it was necessary to slightly modify the format of the rules of the Buffalo bungalow grammar in order to relate it to the grammar for traditional American houses in State College and also to the grammar for Hajjar’s architecture. An important similarity between the grammar for the bungalows and the grammar developed for Hajjar’s single-family architecture is that both grammars start from the overall inhabitable space and then proceed to the allocation of spaces based on public and private functions. Of course, the allocation of spaces or the way in which the larger spaces are divided

into smaller spaces or rooms depends to a great extent on both the technological and cultural aspects of the context: for example, the maximum width of a room is a dependent variable of the maximum beam span, whereas the spatial flow or openness of the living room, dining room, and kitchen is very much related to prevailing notions of privacy in domestic life.

Similar to the grammar of the Buffalo bungalows, in Hajjar’s grammar the inhabitable space can be divided into six (or four) functional spaces/rooms. In Hajjar’s grammar, any of the “rooms,” particularly the middle ones, can be divided into smaller spaces to create small hallways or stairways, or service areas, such as a bathroom or furnace room. On the other hand, in the grammar for the bungalows (like the grammar developed for the traditional houses) additional spaces were introduced between two “rooms” to create stairways or service areas. (Figure 5-5).

Based on the houses in the corpus and the rules adapted from the grammar for the Buffalo bungalows, a grammar was developed for traditional American houses in the State College area. Similar to the grammar for Hajjar’s single-family houses, the grammar for traditional American houses encompasses several groups of rules: rules to define the overall inhabitable space; rules to describe the way in which the interior space is divided into smaller spaces or rooms; rules to allocate the interior functions; and rules to generate details such as the placement of closets, the placement of a fireplace, and the thickness of the walls. The rules of the grammar developed for traditional houses in the area are categorized into four groups based on function (Figures 5-6, 5-7,
The rules are numbered based on the group to which each belongs. For example, group B rules numbered R-B-1 and R-B-2, etc., show the way in which the main inhabitable space is divided into smaller rooms.

Figure 5-6: Rules of the grammar developed for traditional houses, showing the location of the inhabitable space within the lot.

Figure 5-7: Rules of the grammar developed for traditional houses, showing the way in which the main inhabitable space can be divided into rooms.
Figure 5-8: Rules of the grammar developed for traditional houses, showing the allocation of interior spaces.

Figure 5-9: Rules of the grammar developed for traditional houses, showing the development of interior spaces and detailing.
Similar to the grammars developed for Hajjar’s architecture and Gropius–Breuer’s work in the United States, the grammar for American traditional houses in State College can produce all the houses in Table 5-1. Additionally, traditional plans that were not originally part of the corpus can be produced. Figure 5-10 shows the derivation of a design in the corpus used to infer the grammar. The design is related to a house built in the colonial revival (neo-Georgian) style in the College Heights Historic District. It is very similar to the first house Hajjar bought in the area for his family.

Figure 5-10: Derivation of a traditional house based on the generic grammar for American traditional houses in the area.
Grammar Comparison

The focus of this chapter is on comparing the architectural language developed by Hajjar with that of the context in which he practiced in order to determine the extent to which and the ways in which his work can be considered traditional. Similar to the method described in Chapter 4, the rules of the traditional grammar are divided into categories, such as rules to find the inhabitable space, to divide the inhabitable space into smaller spaces/rooms, and to allocate the interior functions. Then, the rules of Hajjar’s grammar are compared with the rules of the traditional grammar within the same category to determine which rules are the same, which have changed, which have not been used (deleted), and which are unique to Hajjar’s grammar (Figures 5-11, 5-12, 5-13, and 5-14). Rules that are the same or very similar are shown with a red border around them. Borders with a zigzag in the middle show rules that underwent a change from one grammar to the other.
Figure 5-11: Comparison of selected rules from the Hajjar grammar and the traditional grammar.
Figure 5-12: Comparison of selected rules from the Hajjar grammar and the traditional grammar.
Figure 5-13: Comparison of selected rules from the Hajjar grammar and the traditional grammar.
Figure 5-14: Comparison of selected rules from the Hajjar grammar and the traditional grammar.
Similar to the method presented in Chapter 4 to compare grammars, in the present chapter a step-by-step derivation of Hajjar’s Snowdon Residence (designed in the 1950s) is compared with a step-by-step derivation of a traditional bungalow house built in 1923 with a four-square plan in the College Heights Historic District (Figure 5-15). The Snowdon Residence was selected because of its similarities—in terms of the geometry and allocation of the spaces within it—to traditional bungalow houses in the area. A comparison of the step-by-step derivations of these two houses is shown in Figure 5-16. The specific rules and the number of rules applied from the two grammars differ across the steps. However, between the two derivations, the results of some of the steps are the same or very similar (these steps are shown with a red border in Figure 5-16).

Figure 5-15: Main floor of a four-square bungalow house in the College Heights District (left) and Hajjar’s Snowdon Residence (right).
Figure 5-16: Comparison of a step-by-step derivation of a four-square plan and Hajjar’s Snowdon Residence, both built in State College, Pennsylvania. The steps with similar results are highlighted with a red border.
In another effort to compare the two grammars—the grammar for Hajjar’s single-family houses and the grammar for American traditional houses—one grammar was used to derive design solutions with a fairly similar organization of a plan produced by the other grammar. Given that the current chapter investigates the influence of traditional architecture of the context on Hajjar’s architectural language, the most logical way to ascertain and confirm (or disprove) similarities between the grammars is to establish in a rigorous way the extent to which houses designed by Hajjar can be generated by the traditional grammar. Figure 5-17 shows the derivation of a house with a layout as close as possible to Hajjar’s Snowdon Residence (Figure 5-18) generated by the traditional grammar.

Figure 5-17: Derivation of a house with a layout as close as possible to Hajjar’s Snowdon Residence using the traditional grammar.
Figure 5-18 shows that the geometry of the respective spaces and the allocation of functions are the same (or very similar) for Hajjar’s Snowdon Residence and the plan generated by the traditional grammar based on Hajjar’s Snowdon Residence. However, Figure 5-18 also shows fundamental differences between the two designs. For example, the entrance is located in the side of the house in Hajjar’s design, whereas for the house generated by the traditional grammar the entrance is front center. With almost no walls in the middle, Hajjar’s plan is more open than the traditional grammar plan in which there is a central hallway. Although the living room is situated in the southern part of the house in both designs, there is also a key difference in this regard: In Hajjar’s design, the fireplace is located in the center of the house where it plays a significant role in separating the interior spaces probably with the goal of saving energy. On the other hand, in the house generated by the traditional grammar, the fireplace seems to be an addition to the exterior wall.
Discussion

As demonstrated in this chapter, to compare Hajjar’s architectural language with the traditional architecture in the State College area, the rules of the grammar developed for Hajjar’s architecture in that locale were compared and contrasted with the rules of the grammar developed for the traditional houses therein. As a basis for analysis, the respective rules of the two grammars were organized into descriptive categories. As the rule numbers in the two grammars—the grammar for Hajjar’s work and the grammar for the traditional houses—do not match, it was necessary to assign each rule to a category. To fulfill this purpose, the rules were categorized in keeping with the comparison of the rules of the grammar for Hajjar’s work and those for the grammar for Gropius and Breuer’s work, as described in Chapter 4. Similar to the procedure described in Chapter 4, the rules are organized according to eleven categories: finding the inhabitable space within the lot, dividing the main inhabitable space into smaller spaces or rooms, defining the garage space, defining the private and public spaces, organizing the spaces in a binuclear organization, defining the interior spaces or rooms, allocating functions to the interior spaces/rooms, defining the interior spaces such as bathrooms and stairs, identifying the interior circulation, defining additions such as porches and/or balconies, and describing the interior detailing. Again, whereas some of the categories consist of as few as two rules, some others have as many as ten rules.

The comparison between the rules of the two grammars—the grammar for Hajjar’s architecture and the grammar for traditional architecture—shows that technical rules in generating layouts can be very similar (e.g., rules to convert a line into a wall). However, the comparison also shows that there are rules with similar shapes but different conditional statements for rule application, which mostly indicate variations in building technologies (e.g., the maximum length of a beam) or building codes (e.g., the setback measurement). There are also
rules specific to each grammar. And, of course, there are rules that are the same or very similar in both grammars, which can explain similarities between Hajjar’s architecture and traditional architecture. From the fifty-one rules in the Hajjar grammar, fourteen are the same as or very similar to rules in the traditional grammar and nine are used with some changes. As argued in Chapter 4, although similarities between these rules show similarities in the architectural productions generated by the two grammars, such similarities do not necessarily indicate that traditional architecture had an influence on Hajjar’s architectural language. For example, similarities between the rules of the two grammars that reflect regulations dictated by building codes and/or a local zoning ordinance do not indicate that Hajjar’s work drew on traditional architecture. The same holds for limitations in relation to local building technologies and likewise for instances in which the rules would be the same or very similar in many architectural languages. However, in 10 to 15 percent of the rules in Hajjar’s grammar, similarities do show the influence of traditional architecture on Hajjar’s architectural language, for instance, the rules related to dividing the main inhabitable space in concentrated plans (square-shaped) into smaller spaces/rooms.

In general, Hajjar’s allocation of interior functions shows similarities with the traditional architecture. However, the flow of spaces and the openness of his interior planning are features that indicate the influence of modern architecture. Given its importance to Hajjar’s success practicing architecture in an American college town in the mid-twentieth century, this hybridity between European modernism and American traditional architecture will be explored in detail in Chapter 6.
Chapter 6


Introduction

The purpose of this chapter is to analyze Hajjar’s single-family houses in State College, Pennsylvania, in comparison with the European modernist work of Walter Gropius and Marcel Breuer in the United States and with the American traditional architecture of the context in which Hajjar taught and practiced. Similar to the analyses presented in previous chapters, this analysis is performed using shape grammar as a computational design methodology. As explained in detail in Chapter 3, the residential architecture Hajjar designed for and built in that context incorporates many of the formal and functional features typical of both European modern architecture and American traditional architecture.

In the preliminary research for this study, Hajjar’s life and practice were traced in order to identify influences on his work. In Chapter 3, a shape grammar for the houses he designed in the State College area was developed. In Chapters 4 and 5, shape grammars for major influences—i.e., European modern and American traditional architecture—on his work were developed. Against that background, in the present chapter, Hajjar’s grammar will be compared and contrasted with the grammars of those influences in order to determine the nature of these and the likely impact of each on Hajjar’s work.
Shape Grammar

As described in detail in Chapter 2, shape grammars in computation are a specific class of production systems based on an initial shape, or a set of finite shapes, and transformational shape rules. Since the 1970s, as a design computation method, the concept of shape grammar has been used in architectural analysis when a pattern of design characteristics or a stylistic repetition of shapes in architecture is evident.

In Chapters 3, 4, and 5, the procedure according to which the rules of the grammars were developed are described in detail for (1) Hajjar’s single-family houses in State College, (2) Gropius and/or Breuer’s single-family houses in the United States, and (3) traditional single-family houses in State College, as the context in which Hajjar practiced. To refresh the reader’s memory, Figures 6-1, 6-2, and 6-3 represent selected rules of those three grammars.

---

Figure 6-1: Selected rules of the grammar developed for Hajjar’s work in State College, Pennsylvania.
Figure 6-2: Selected rules of the grammar developed for Gropius and/or Breuer’s work in the US.
Figure 6-3: Selected rules of the grammar developed for traditional houses.
Comparison and Discussion of the Grammars Developed

As described in detail in Chapter 1 of this study, the author focused on using the shape grammar methodology to compare Hajjar’s architecture in State College with both single-family houses designed by Gropius and/or Breuer in the United States and the traditional houses in the context. In order to do this, it was necessary to compare and contrast the rules of the three grammars. Developing the three grammars following the same process and with the same level of detail made it possible to compare the rules on a like-with-like basis. The rules of the three grammars were organized according to eleven categories, e.g., rules for volumetric organization, rules for dividing the inhabitable space, rules for private vs. public spaces, rules for dividing the interior space, and rules for interior organization-circulation. Then, the rules were compared to determine which rules in Hajjar’s grammar were borrowed with or without adaptation from the other two grammars and which rules were created from neither of the two grammars. Figures 6-4, 6-5, 6-6, and 6-7 show the comparison of the rules of the three grammars. As shown in the figures, some rules are the same (or very similar) across all three grammars, some rules are the same (or very similar) for two of the three, some rules have changed from one grammar to another, and some rules are unique to a given grammar.
Figure 6-4: Comparison of the inhabitable space rules, the inhabitable space division rules, the garage space rules, and the private vs. public rules of the three grammars.
Figure 6-5: Comparison of the binuclear organization rules and the interior space division rules of the three grammars.
Figure 6-6: Comparison of interior function allocation rules and the interior organization rules of the three grammars.
Figure 6-7: Comparison of the interior organization–circulation rules, interior detailing (situating closet/fireplace) rules, and addition/porch/entry rules of the three grammars.
Although the main purpose of this comparison was to analyze the qualities of Hajjar’s architectural language and to determine how it reflects traditional American architecture and the influence of European modern architecture (the latter represented here by the Gropius–Breuer partnership), the shape grammar methodology provides a way to quantify these influences. A comparison of the respective rules reveals the following: In relation to the Gropius–Breuer grammar, 54 percent of Hajjar’s rules are the same (or with very minimal changes), 13 percent reflect an adaptation (used with some modifications), and 33 percent are new rules. In relation to the traditional grammar, 29 percent of Hajjar’s rules are taken without any changes, 17 percent reflect an adaptation (used with some modifications), and 54 percent are new rules. In relation to Hajjar’s generation of his own rules, 25 percent of the rules in his grammar are not used in either the Gropius–Breuer grammar or the traditional grammar. Finally, in relation to a comparison across all three grammars, 25 percent of the rules used by Hajjar are also the same in the other two grammars, meaning that the three grammars all have the same 25 percent of their rules in common (Figure 6-8). This 25 percent commonality does not necessarily indicate the influence of one grammar on the other two, mutual influences among them, or the influence of another grammar on all three grammars developed herein. Instead, it reflects the idea that a house is a house regardless of its designer, its style, or the time period in which it was built.

It is also worth noting that the Gropius–Breuer grammar has 30 percent of its rules in common with the traditional grammar, and 7 percent of the rules reflect an adaptation (are used with some modifications). Based on these same rules and similar rules, we can expect to find similar results in many architectural languages, reflecting the extent to which a house is a house. However, 10 percent of the rules in the grammar for Gropius and/or Breuer’s work in the US are similar to the rules in the traditional grammar in a way that suggests that their work in the United States was to some extent influenced by American traditional architecture.
Another effective way of considering possible similarities between shape grammars is through a step-by-step comparison of their derivations, in this case between those of a house designed by Hajjar, a house designed by Gropius–Breuer, and a house from the traditional context. This approach is explored in detail in relation to Hajjar’s architecture and Gropius–Breuer’s architecture in Chapter 4 and in relation to Hajjar’s architecture and traditional architecture of the context in Chapter 5.

A third approach is to use a grammar to produce a house that was used to derive another grammar. For example, through a grammar of Hajjar’s work, a Gropius–Breuer house (a house with a layout as close as possible to a Gropius–Breuer house) can be created that is then compared with the original Gropius–Breuer design and vice-versa. The same strategy can, of course, be used to compare Hajjar’s grammar with the traditional grammar. Figure 6-8 shows a traditional house with a common traditional interior plan built in the late 1920s in College Heights that was used to infer the traditional grammar explained in Chapter 5. Hajjar’s grammar was used to generate a design as close as possible to the interior organization of this traditional plan. The step-by-step derivation of this “Hajjar-inspired” house is shown in Figure 6-10. It is an
open-plan house with the proportions of the house shown in Figure 6-9: a house that Hajjar could have designed.

Figure 6-9: American traditional house built in 1928 in the College Heights Historic District in State College, Pennsylvania, which was used to derive the traditional grammar.

Figure 6-10: Derivation of a design generated by the Hajjar grammar similar to the interior plan of the house in Figure 6-9.

As noted in Chapter 5, given that the present study investigates the influence of Gropius–Breuer’s modern architecture and the influence of the traditional architecture in the context on Hajjar’s architectural language, the most logical way to ascertain and confirm (or disprove) similarities between the grammars is to establish the extent to which houses designed by Hajjar can be generated by the Gropius–Breuer grammar and by the traditional grammar. Figure 6-11
shows the derivation of a house with a layout as close as possible to Hajjar’s Snowdon Residence (Figure 6-12) as generated by the traditional grammar.

![Derivation of a house generated by the traditional grammar with a layout as close as possible to Hajjar’s Snowdon Residence.](image)

**Figure 6-11:** Derivation of a house generated by the traditional grammar with a layout as close as possible to Hajjar’s Snowdon Residence.

![Hajjar’s Snowdon Residence (left) and a house of the same size with a similar layout generated by the traditional grammar (right).](image)

**Figure 6-12:** Hajjar’s Snowdon Residence (left) and a house of the same size with a similar layout generated by the traditional grammar (right).
It is certainly the case that similarities in relation to the size of the habitable space and to some extent the proportions and allocation of interior functions to rooms, as well as differences in the openness of the interior layout and the interior circulation reflect similarities and differences between the rules of the grammar for Hajjar’s work and the grammar for traditional houses in the area. However, it remains important to understand that these similarities and differences relate to similarities and differences in lifestyle between the two periods. For instance, the kitchen and the dining area are smaller in Hajjar’s Snowdon Residence than in the house generated by the traditional grammar with a layout as close as possible to Hajjar’s Snowdon Residence. This difference may relate to a change in family size between the two periods. According to most census estimates, on average, an American family in 1800 had seven to eight children whereas in 1900 that number had dwindled to 3.5.219 This marked difference may explain why in comparison to a mid-twentieth-century house an American traditional house needed both a larger dining room and a larger kitchen. On the other hand, the living area is larger in Hajjar’s house than in the house generated by the traditional grammar. As explained in Chapter 2, the idea of social relationships between coworkers had changed in the mid-century United States. People were holding more parties at their houses to which coworkers were invited during that period than had been the case earlier. Further, the role of women had also changed in these social relationships. That is, women had become more involved in these parties, and that is a reason we see a greater openness between the kitchen and the living area in houses in the mid-twentieth century than before that time.

It is important to note that this method of comparison—comparing a Hajjar house plan with a plan generated by the traditional grammar with a layout as close as possible to Hajjar’s house—is not based on any assumption about the square footage of the traditional-style houses or

on the assumption that these houses had only an entrance, living room, dining room, and kitchen on the first floor. Instead, this method of comparison helps us to understand the extent to which Hajjar’s architecture is traditional. It is also important to note that the social justifications for the differences between the two floor plans described above is based only on the literature about the social environment of the twentieth-century United States and a limited study of the local context by the author. For a better understanding of the similarities and differences between the grammars, a deeper social study of the local context is needed, which is outside the scope of the present study.

The same strategy of generating a similar house through a different grammar is used to generate a layout as close as possible to a Hajjar design with the Gropius–Breuer grammar. Figure 6-13 shows Hajjar’s Eakin Residence built in the College Heights neighborhood (a neighborhood north of the Penn State campus, where many of Hajjar’s houses were built) in 1955. The house is a split-level with the garage located at the bottom (ground level) of the bedroom volume. The Eakin Residence was selected because it is a great example of a house designed by Hajjar in a split-level organization—a mid-century American architectural feature—with a binuclear interior plan—an architectural feature that separated day-time activities into one volume and night-time activities into another volume, as used by Breuer in the United States. The Gropius–Breuer grammar is used to generate a plan as close as possible to the main-floor layout of the Eakin Residence. A step-by-step derivation of this design is shown in Figure 6-14.
Figure 6-13: Original drawings of the Eakin Residence by Hajjar.

Figure 6-14: A step-by-step derivation of a design as close as possible to Hajjar’s Eakin Residence, generated by the Gropius–Breuer grammar.
Whereas both the Hajjar grammar and the Gropius–Breuer grammar generate binuclear layouts, in the Hajjar grammar the connecting part, usually a breezeway in Hajjar’s designs, is an inhabitable space that can be used for interior functions. Further, in the Gropius–Breuer grammar, this connector is mainly a transitional space between the public and private parts of the house. In the private part of the house, the Hajjar grammar can easily generate a family room, or what Hajjar referred to as a sitting room, whereas the Gropius–Breuer grammar instead of producing that space generates a wider corridor, which itself can function as a gathering space within the private part of the house. Therefore, instead of a sitting room, it has an extra bedroom. Having four bedrooms, a wider corridor, and two bathrooms (one for a master bedroom and one shared), the design generated by the Gropius–Breuer grammar has smaller bedrooms than those in the design generated by the Hajjar grammar. This difference may reflect a change in lifestyle. Although the grammar for Gropius–Breuer’s work was developed based on their single-family houses designed in the United States, many of their ideas are rooted in European modernism. Therefore, the change in the size of the bedrooms may be related to differences between modern European life and lifestyles prevalent in American college towns.

Hajjar’s Eakin Residence is split-level such that it is similar to many other houses situated in the hilly part of the neighborhood. The Gropius–Breuer grammar cannot generate a staircase within the connector, as houses designed by these architects whether as individuals or in partnership did not include that feature, which means a split-level organization is not possible. Figure 6-15 shows the main floor plan of the Eakin Residence designed by Hajjar and generated by the Hajjar grammar and the plan generated by the Gropius–Breuer grammar as close as possible to the layout of the Eakin Residence.
A comparison of the rules of the grammars shows that the technical rules across all three grammars for generating the layout are very similar (e.g., rules for converting a line into a wall). However, the comparison also shows rules with similar shapes but different descriptions, which predominantly reflect variations in building technologies (e.g., the maximum length of a beam) and building codes (e.g., the extent of setbacks), as noted in Chapter 5. There are also rules specific to each grammar and rules that are the same or very similar in all three grammars, the latter of which can explain similarities between and the influences of modern architecture and traditional architecture on Hajjar’s production. As noted in Chapter 5, a comparison between the Hajjar grammar and the traditional grammar shows that Hajjar’s allocation of interior functions has similarities with that of the traditional architecture. However, the flow of spaces and the openness of his interior planning lean toward modern principles of design. Likewise, his attention to the idea of energy-efficiency, which is reflected in, for example, his positioning of the fireplace as a main design aspect of the interior circulation rather than as a feature on an exterior wall. In fact, these are all design elements that it is likely Hajjar learned from Anderson, his supervisor at MIT, and through interacting with and studying the work produced by Gropius and Breuer. This hybridity between European modernism and American traditional architecture was a key to Hajjar’s success in practicing architecture in an American college town in the mid-twentieth
century. Of course, changes in people’s lifestyles and the cultural and socio-economic changes after World War II in the United States led to a reassessment of the principles of residential architecture across the country—a need to which contractors and architects responded nationwide.
Chapter 7

Conclusion

The purpose of this chapter is threefold: to summarize the research presented in this study, to briefly describe its key contributions to the field, and to propose directions for future work.

Summary

The foundational research for the present study focused on documenting examples of mid-twentieth-century architecture in college towns across the US. Through this process, it was discovered that many such towns include multiple single-family houses designed by full-time faculty members who held positions with NAAB-accredited architecture degree programs at the colleges situated there. Many of these houses, including those designed by Hajjar in State College, Pennsylvania, do not fully fit the existing mainstream taxonomy of the period inasmuch as they are not built according to popular mid-century ranch, split-level, shed, or minimal traditional styles. Nor do they feature the characteristics or shapes of modern architecture such as flat roofs, ribbon windows, and free façades, as first identified by Henry Russell Hitchcock and Philip Johnson (1932) and later by scholars such as Kenneth Frampton and William Curtis. Furthermore, these houses are not colonial, revival, or Victorian in appearance and, therefore, do not conform to traditional American styles. Instead, many of the houses simultaneously reflect traditional American styles together with forms associated with modernist ideologies: for example, some houses boast sloped roofs, partially open plans, large windows, a horizontal organization in a split-level arrangement, and a traditional balloon frame with local stone, wood, or brick cladding.
To verify and describe the hybridity between European modern architecture and American traditional architecture in Hajjar’s work in State College, this study offers an investigation of this faculty-practitioner’s architecture by comparing and contrasting it with traditional houses in the area and with European/Bauhaus internationalism. The focus of this approach is a comparison with the work of Gropius and Breuer in the US, both of whom Hajjar had met during his architecture studies. The investigation was performed by developing three shape grammars in order to analyze their respective architectural languages: a grammar for single-family houses designed by Hajjar in State College, a grammar for single-family houses designed by Gropius and/or Breuer in the United States, and a grammar for traditional houses in the State College area, i.e., the context in which Hajjar both taught and practiced architecture. It is important to note that these grammars were developed based on the volumetric relationship, interior organization, and functional allocations of the types of houses referred to above, and their relationship with contextual studies including the technological limitations/innovations and the socio-economic context of the mid-century United States. The three grammars were then compared and contrasted in order to understand the ways in which and the extent to which Hajjar’s architectural language was influenced by the other two architectural languages. Further, based on the preliminary studies presented, it is evident that volumetric relationship, interior organization, and functional allocations, i.e., the overall plans of the architectural productions, are key to explaining the relationships between the architectural languages explored. Likewise, these features are decisive in determining the influence of Gropius and/or Breuer’s work in the US and the influence of the traditional architecture of the context on Hajjar’s architecture.

In relation to the contextual studies, as explained in terms of the comparison of the rules presented in Chapter 6, multiple developments are pertinent to the similarities and/or differences between the rules of the three grammars. These include changes in family size and life styles from traditional to modern life in the United States, changes in life style from modern European
life to American college town life, changes in governmental policies after World War II, changes in the building industry and building technologies, and the availability of new construction materials or limitations in building technologies in a remote college town.

**Contributions**

As described in Chapter 1, the duality between modern and traditional, international and local, and designed and vernacular in architectural practice has been addressed in a number of different ways in the literature, including in relation to ideas such as high-style versus popular architecture, popular modernism, critical regionalism, and vernacular modernism. However, analyzing the hybridity between modern architecture and traditional architecture as expressed through the domestic architecture found in American college towns has not been addressed. Additionally, using shape grammar as a computational methodology is a unique way of analyzing the notion of hybridity and provides a basis for the production of hybrid architecture in future research studies. In general, the present study contributes to the discipline of architecture both in terms of context and methodology: In relation to Hajjar’s architecture in the State College area, this study highlights his contributions to the local history of architecture. Similar to many other architects in the mid-twentieth-century United States, Hajjar was well aware of and influenced by European modernism. However, similar to other architects, he was also aware that this style of architecture was inaccessible to the average client even in a highly educated liberal college town. This understanding of the particular business environment might be a reason that Hajjar, and others, adapted European modernism to the local context to create a mixed style that would appeal to clients. Therefore, it can be argued that Hajjar tried to normalize European modernism with his technique of hybridization and thus made modernism accessible and to some extent stable and popular in the State College area and in the United States more generally. This
argument or hypothesis, however, requires consideration in further research if it is to be proved/disapproved. Further, the present study highlights Hajjar’s roles as a teacher and practitioner who followed in the footsteps of Gropius and Breuer in localizing/Americanizing Bauhaus culture in the United States. In relation to the methodology, this study demonstrates that shape grammar as a computational design methodology can be an effective way for researchers to verify and describe the influence of the work of one or more architects or architectural styles on the work of another architect or architectural style, and, therefore, for identifying hybridity in architectural design. Overall, this study makes several major and minor contributions to the field of architecture, as described in the next section.

Before stating the findings of the present study and its contributions to the literature, it is important to note that the purpose of this study is not to promote the production of Hajjar-inspired houses. While both the Hajjar grammar and the computer program developed based on the grammar can produce floor plans based on or very similar to Hajjar-designed floor plans, every architect brings his/her own poetry to bear on every project. Thus, although it is hoped that the grammar can help contemporary architects to see some elements in Hajjar’s designs to emulate, modify, incorporate into, or contradict in their own work, the hope is not that they will reproduce his work but that they will have greater awareness of his contributions to the history of architecture. Further, the grammar (and the computer program) may be able to produce houses inspired by Hajjar’s architecture, but these may not be Hajjar houses after all.

**Major Contributions/Findings**

A systematic methodology for analyzing hybridity in architectural design. The focus of this study was an analysis of Hajjar’s architectural language including through a comparison with Gropius–Breuer’s architectural language and the American traditional architecture of the local context.
Through these comparisons, this study demonstrates the effectiveness of shape grammar as a computational design methodology in verifying and describing hybridity in architectural design.

It is important to note that to a certain extent the idea of comparing grammars has been explored in multiple ways in the literature. For example, such comparisons have been used in endeavors to explain the following: the evolution of art and architecture in the work of a given artist or architect (Knight, 1994); the notion of a composite grammar—a grammar to merge languages that can be transformed when they come in contact with other languages—as a framework to analyze the evolution of historical architecture (Chase & Ahmad, 2005); the influence of Alberti’s *Treatise on Architecture* on Portuguese Renaissance architecture (Figueiredo et al., 2014; Kruger et al., 2011); the adaptation of existing traditional houses to new requirements (Eloy & Duarte, 2014); and the ability to generate a generic housing grammar from three existing grammars (Benróis, 2018). However, in the present study, this methodology is used to verify and describe—in both qualitative and quantitative terms—hybridity in architectural design.

Hajjar’s architecture is a hybrid architecture that represents influences from both European modern and American traditional architecture. As hypothesized based on the author’s architectural intuition during the early stage of the research, Hajjar’s single-family architecture shows a hybridity between European modern and American traditional architecture. This hypothesis initially derived from the author’s examination of Hajjar’s work in the State College area, followed by archival research, and the exercise of tracing his life and practice. Its validity was confirmed by comparing Hajjar’s architectural language—via the rigorous framework provided by shape grammar—with the work of Gropius and Breuer in the United States and the traditional architecture of the local context in which Hajar taught and practiced.
The socio-economic context and building technology of the period influenced Hajjar’s designs. The present research does not focus on comparing the socio-economic situation and technological limitations/innovations of the contexts in which Hajjar practiced, Gropius and Breuer practiced, and the American traditional houses evolved. However, these influences are reflected in the rules of the grammars used to analyze Hajjar’s architectural language.

**Minor Contributions/Findings**

Hajjar is not the only practitioner to reflect hybridity in his designs in the mid-twentieth-century United States. This hybridity between European modern and American traditional architecture is a characteristic of the work of a number of faculty-practitioners in American college towns in the mid-twentieth century. It can be found most especially in designs produced by faculty-practitioners who had studied or at least been exposed to modern architecture in programs either led by or that included a European avant-garde architect who had immigrated to the US during the late 1930s and early 1940s period.

College town modernism may be an architectural style that is unique to the mid-century period. This notion of hybridity in the architectural language of faculty practitioners in American college towns in the mid-twentieth century may be considered a unique architectural style in the United States—what the author would like to call “college town modernism.” The idea of college town modernism, therefore, constitutes a theme for future exploration.
Future Work

The present study constitutes a major step towards the development of a systematic approach to analyzing the influence of the work of specific architects/architectural styles on the work of another architect/architectural style, and to producing new hybrid architecture, i.e., a localized international architecture. A new methodology is developed in the present study to analyze hybridity or a comparative generation of elements from multiple architectural styles. In this regard, ideas for future work fall into two categories: improving the current research and incorporating major steps toward implementing that systematic approach. The improvements and major steps are considered briefly next.

Improvements

Revisit the three grammars for further improvements. The three grammars described in this research are revisited several times in the present study, including the process through which each was developed and the process whereby each was subjected to a process of comparison. Yet, it would undoubtedly be worthwhile to consider them in additional ways. For example, some of the rules identified could be combined and consolidated as a basis for understanding the grammars in a more comprehensive way.

An ideal way of evaluating and testing the effectiveness of a grammar, for example, the grammar developed for Hajjar’s work, is to compare and contrast floor plans generated by the grammar with floor plans designed by the original architect. In case of Hajjar’s grammar, this comparison of designs generated by the grammar with the architect’s work can be best done by an expert of Hajjar’s work, for example, Mark, his son, who worked in Hajjar’s office in State College for a few years.
Develop façade grammars. According to the preliminary studies, the influence of Gropius and/or Breuer’s work in the United States and the influence of the traditional architecture of the context on Hajjar’s architectural language can be explained best in reference to the plans and interior layouts of the houses Hajjar designed. However, it should be noted that the development of the façade grammars can complement the layout grammars, thereby making it possible to verify aspects that are visible in relation to exterior elements.

Develop three-dimensional grammars. One of the aspects noted several times in the present research is the volumetric organization of Hajjar’s houses: the special organization of the garage and the inhabitable space with a breezeway as the connector. This particular organization is studied through the analysis of floor plans and the development of two-dimensional shape grammars. However, it would be optimal to instead offer an analysis and comparison of architectural languages through three-dimensional shape grammars. Development, analysis, and comparison of three three-dimensional grammars was outside the scope of the present study due to time constraints. Yet, after the façade grammars are developed, and an endeavor to develop three-dimensional grammars would be the next step.

Improve the computer program used to produce Hajjar-inspired designs. As briefly discussed in Chapter 3, a computer program was developed with Python scripting language in the Rhino interface to test the effectiveness of the Hajjar grammar in producing both Hajjar’s original designs and new designs based on the grammar. This computer program was developed by the author in an introductory course on Python. Given the author’s limited programming skills, however, engaging the services of a computer programmer to develop a more organized, optimized, and effective program will be critical to implementing a more fully realized systematic approach to analyzing and producing hybrid architectural designs.
Continue understanding the effect of the social context on the rules of a hybrid grammar. The rules of the three grammars—especially the Hajjar grammar—were developed based on the relationship between the social context and the respective architectural language. However, there is still a gap between our understanding of the shape rules of the grammars and the social context associated with them. It is important to add, as stated in Chapter 6, that the social analysis of the context was based on a review of the literature for the broader context of the United States, which may or may not be applicable to the context of a central Pennsylvania college town. Additional investigations into the socio-economic situation of the mid-twentieth century and especially of the local context will further the field’s understanding of this methodology and provide a stronger foundation for optimizing the shape rules of the grammars. These further investigations may answer a question raised during the present study: Why did people want these hybrid houses in a college town like State College? This question itself presents a theme for future exploration.

**Major steps**

**Expand the boundaries and test the results of the research in other geographical locations.** In order to develop a systematic approach to analyzing and producing architectural hybridity, it will be necessary to test the shape grammar methodology developed in the present study in other geographic locations around the world, including in other American college towns. The goal of such testing would be to determine the methodology’s applicability to other regions representing multiple socio-economic situations. Further, such testing will help to more clearly define the idea of “college town modernism” as applied to other American college towns.
Consider the systematic approach presented in this research for types and styles of architecture across all eras. Two possible avenues in this regard are (1) to consider the architecture of the past in order to show that architecture evolves through a hybridization process and (2) to imagine an architecture of the future by applying a process of hybridization to generate new architectural styles appropriate to a given context.

The initial hypothesis of the present study was that Hajjar’s is a hybrid architecture between European modernism and American traditional architecture. However, some way through the steps taken to prove/disprove the hypothesis, the methodology used for this purpose overtook the goal of proving/disproving the hypothesis. The tool/methodology developed during the process became one of the most important outcomes of the study. This tool/methodology can serve architects, historians, and more broadly the housing industry for future research and projects in generating hybridity in architectural design and contextualizing international and up-to-date architecture.

Explore the idea of “college town modernism.” As explained in Chapter 1 and noted in the “findings” section, it is important to understand that the present study can be understood as a case study of a much larger phenomenon whereby the context is a subset of American urban centers where the population includes a higher percentage of open-minded cliental than is the case elsewhere.
Bibliography


https://www.aaa.si.edu/collections/interviews/oral-history-interview-lawrence-anderson-12388.


Flemming, U. “More Than the Sum of Parts: The Grammar of Queen Anne Houses.”


Kempton, Ralph C. “Architect and Practice of Architecture.” *National Architect*, 6 (December


Langford, Ernest. The First Fifty Years of Architectural Education at the Agricultural and Mechanical College of Texas. College Station, TX: College Archives, Agricultural and Mechanical College of Texas, 1957.


Appendix A

Faculty-Practitioners in College Towns with Architecture Degree Programs in the Mid-Twentieth Century

<table>
<thead>
<tr>
<th>Univ.</th>
<th>Town</th>
<th>Architect</th>
<th>Modern</th>
<th>Faculty</th>
<th>Local</th>
<th>Info</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Auburn University Land Grant</td>
<td>Auburn, AL</td>
<td>Paul Rudolph</td>
<td>Y</td>
<td>Yale</td>
<td>N</td>
<td>Auburn graduate-2 houses</td>
</tr>
<tr>
<td>2</td>
<td>U of Florida Land Grant and Flagship</td>
<td>Gainesville, FL</td>
<td>Harry Merritt</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Sarasota School</td>
</tr>
<tr>
<td>3</td>
<td>U of Idaho Flagship</td>
<td>Moscow, ID</td>
<td>Arthur L. Troutner</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Graduate of program, practicing in southern part-only Kibbie dome</td>
</tr>
<tr>
<td>4</td>
<td>U of Illinois Land Grant and Flagship</td>
<td>Urbana-Champaign IL</td>
<td>Jack S. Baker</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A Richard Williams</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Dick Williams is alive 101</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>John Replinger</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Iowa State Land Grant</td>
<td>Ames, IA</td>
<td>Charles E. Herbert</td>
<td>Y</td>
<td>N</td>
<td></td>
<td>of Herbert Lewis Kruse Blunck (HLKB)</td>
</tr>
<tr>
<td>Univ.</td>
<td>Town</td>
<td>Architect</td>
<td>Modern</td>
<td>Faculty</td>
<td>Local Info</td>
<td>Example</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>-----------------</td>
<td>----------------------------</td>
<td>--------</td>
<td>---------</td>
<td>----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>U of Michigan</td>
<td>Ann Arbor, MI</td>
<td>Ray Crites of Crites and McConnell</td>
<td>Y</td>
<td>N</td>
<td>Colombia and Taliesin trained Dr. and Mrs. Harry Towsley residense</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aiden Dow</td>
<td>Y</td>
<td>N</td>
<td>Colombia and Taliesin trained Dr. and Mrs. Harry Towsley residense</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clifford Wright</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Detroit Based</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>David Osier</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Worked with C Wright</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Douglas Loree</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ed Olencki</td>
<td>Y</td>
<td>Y</td>
<td>Studies at IIT under Mies- Worked for Mies- Joined UM in 1948 Professor and Mrs Leonard Eaton residence (1964)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eero Saarinen</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Moore building at UM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>F.L. Wright</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>William and Mary palmer House</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>George Brigham</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Trained in Beaux-Arts at MIT- taught at Cal Tech (became interested in modernism)- Joined UM in 1930- designed over 40 houses</td>
<td>Mr. and Mrs. George Brigham Residence and studio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Herbert Johe</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Joined UM in 1947- built nine houses- Scandinavian influence</td>
<td>Mr. and Mrs. Walter Holcomb Residence (1959)</td>
</tr>
<tr>
<td>Univ.</td>
<td>Town</td>
<td>Architect</td>
<td>Modern</td>
<td>Faculty</td>
<td>Local</td>
<td>Info</td>
<td>Example</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
<td>-----------</td>
<td>--------</td>
<td>---------</td>
<td>-------</td>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>James Wong</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joseph Lee</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Various trainings- Columbia- Worked for FLW- joined UM in 1952</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joseph Albano</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Trained at IIT under Mies(1944-46)- Joined UM in 1947-Partner with Ed Olencki</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ralph Gerganoff</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Graduated from UM in 1917- Started with other styles-continued with Art deco and modern- mostly worked in Ypsilanti</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Robert Metcalf</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Trained at and a faculty of UM- designed homes for many faculty members (alive)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Robert Pond</td>
<td>Y</td>
<td>N</td>
<td>A few years</td>
<td>Trained at Taliesin- worked for George Brigham- designed 2 houses in the area-left to work for Wright (alive)</td>
<td>Mr. and Mrs. Theodore Kabza Residence (1961).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ted Smith</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tom Tanner</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Trained at U of Illinois and UM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tivadar Balogh</td>
<td>Y</td>
<td></td>
<td></td>
<td>Trained at and faculty of UM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Walter Sanders</td>
<td>Y</td>
<td>N</td>
<td>N-Y</td>
<td>NY architect, moved to the area in 1949</td>
<td>Mr. and Mrs. Oscar Eberback Residence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Will Muschenheim</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Trained at MIT &amp; in Bauhaus under Peter Behrens in Vienna- Joined UM in 1950 (was a NY a NY architect</td>
<td>Mr. and Mrs. William Muschenheim Residence (1954)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>James Livingston</td>
<td>Y</td>
<td>N</td>
<td></td>
<td>Trained at UM- designed 11 houses and a couple of public buildings</td>
<td></td>
</tr>
<tr>
<td>Univ.</td>
<td>Town</td>
<td>Architect</td>
<td>Modern</td>
<td>Faculty</td>
<td>Local</td>
<td>Info</td>
<td>Example</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
<td>-----------</td>
<td>--------</td>
<td>---------</td>
<td>-------</td>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>6</td>
<td>Cornell Private-Land Grant</td>
<td>Ithaca, NY</td>
<td>Thomas H. Canfield, Sr.</td>
<td>Y</td>
<td>Y</td>
<td>Mostly designed buildings in Ithaca College</td>
<td><img src="image" alt="505 Burson Place" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Raymond Viner Hall</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td></td>
<td><img src="image" alt="Raymond Viner Hall" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>John Clair Miller</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Trained at Ohio State and Cornell- Worked in NY- established his practice in the area from 1965- Joined Cornell faculty in 1977</td>
<td><img src="image" alt="Miller residence (1974)" /></td>
</tr>
<tr>
<td>7</td>
<td>Miami U Flagship (Public Ivy)</td>
<td>Oxford, OH</td>
<td>Victor Fürth</td>
<td>Y</td>
<td>Y</td>
<td>Czech- moved to US</td>
<td><img src="image" alt="Miami U Flagship (Public Ivy)" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C.E. “Mike” Stousland</td>
<td>Y</td>
<td>Y- chair</td>
<td></td>
<td>Yale, Rice, Cranbrooke</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Andy” Wertz/“Kep” Small/Hal Barcus</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Long-time faculty and partners</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>David B. Maxfield</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Built numerous houses (and churches)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Penn State Flagship/ Land Grant</td>
<td>State College, PA</td>
<td>A. William Hajjar</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percy Ash</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Tudor, Georgian, Colonial</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clarence Bauchspies</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>John Robert Bracken</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Head Landscape dept</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Raniero Corbelletti</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Head Arch, Dept 68-88</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Frederick Disque</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>(Earlier) Gerogian, Colonial Revival</td>
<td></td>
</tr>
<tr>
<td>Univ.</td>
<td>Town</td>
<td>Architect</td>
<td>Modern</td>
<td>Faculty</td>
<td>Local</td>
<td>Info</td>
<td>Example</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>-----------------------</td>
<td>--------</td>
<td>---------</td>
<td>-------</td>
<td>----------------------------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kenneth Heidrich</td>
<td>N-Y</td>
<td>Y</td>
<td></td>
<td>Became a Wrightian architect in 50s</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Salmon and Salmon</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Philip Hallock</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>From late 40s to early 70s he designed more than 31 projects</td>
<td>Hallock I House (1947)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paul Boyd Kapp</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Worked with Kennedy and Eden</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dean Kennedy</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laurence Kocher</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Colonial Revival, earlier worked with Disque</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Harry Smith</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Cape Cod-English Revival-Spanish Revival 1930s</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Clemson U</td>
<td>Harlan Ewart McClure</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Clemson does not have a clear architectural identity-no primary architect</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land Grant</td>
<td>(Dean of the College)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Texas A&amp;M</td>
<td>CRS and many others</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>CRS was an international office started in College Station</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land Grant</td>
<td>College Station, TX</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Virginia Tech</td>
<td>Leonard Currie</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Two Houses in Blacksburg- NHR-Pioneered Solar design in the area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land Grant</td>
<td>(founder of the college-studied with Gropius)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Univ.</td>
<td>Town</td>
<td>Architect</td>
<td>Modern</td>
<td>Faculty</td>
<td>Local Info</td>
<td>Example</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
<td>-----------</td>
<td>--------</td>
<td>---------</td>
<td>------------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>1 2</td>
<td>UVA Flagship</td>
<td>Charlottesville, VA</td>
<td>James Tulley</td>
<td>Y</td>
<td>Y</td>
<td>[SAH Pinterest: Van Groll House 1990, James Tulley, 517 2nd Street NE C'Ville]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carlo Pellechi</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 3</td>
<td>Washington State Land Grant</td>
<td>Pullman, WA</td>
<td>Dave Scott Director of the program in 70s</td>
<td>☐</td>
<td>Y</td>
<td>Mostly 1970s</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B

Single-Family Houses Designed by William Hajjar in State College, PA in the Mid-Twentieth Century

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Original Owner(s)</th>
<th>Owner’s Occupation</th>
<th>Orientation-N is up</th>
<th>Main floor area</th>
<th>Const. date</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hajjar I Res.</td>
<td>520 Westview Ave</td>
<td>William and Anne Bortz Hajjar</td>
<td>Architect-Prof. of arch. at PSU</td>
<td>1,020 SF (W/O the garage and breezeway)</td>
<td>1952</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lowenfeld Res.</td>
<td>728 Franklin Street</td>
<td>Viktor and Gretta Lowenfeld</td>
<td>Head-Dept. of Art Education, PSU</td>
<td>1,890 SF (W/O indoor open connection-W/O garage and yard and porch)</td>
<td>1954</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metzger Res.</td>
<td>555 Hillcrest Ave</td>
<td>Fred and Helen and Laura W. Metzger</td>
<td>Well-known businessman in town</td>
<td>1,623 SF (W/O porch and attached garage)</td>
<td>1954</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eisenstein Res.</td>
<td>931 Robin Rd</td>
<td>Julian and Elizabeth Lewisohn Eisenstein</td>
<td>Julian was Scientist-Elizabeth art collector</td>
<td>3,324 SF (W/O porch)</td>
<td>1954-altered</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mebane Res.</td>
<td>942 Robin Rd</td>
<td>Tom S. and Barbara Mebane</td>
<td>Tom was a medical doctor</td>
<td>1,882 SF (W/O the porch)</td>
<td>1954</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skell Res.</td>
<td>919 W Fairmount Ave</td>
<td>Philip and Margo Skell</td>
<td>Evan Pugh Prof Emeritus at PSU</td>
<td>C. 2,016 SF (W/O garage)</td>
<td>1954</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Address</td>
<td>Original Owner(s)</td>
<td>Owner's Occupation</td>
<td>Orientation-N is up</td>
<td>Main floor area</td>
<td>Const. date</td>
<td>Image</td>
</tr>
<tr>
<td>------------</td>
<td>---------------</td>
<td>----------------------------------------</td>
<td>-------------------------------------</td>
<td>---------------------</td>
<td>-----------------</td>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>Ranz Res.</td>
<td>952 Robin Rd</td>
<td>William E. and Lucile Ranz</td>
<td>Prof. of Engineering at PSU</td>
<td>2088 SF</td>
<td></td>
<td>1954</td>
<td><img src="image1.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Higdon Res.</td>
<td>914 Robin Rd</td>
<td>Robert and Mary Higdon</td>
<td>HRB-Singer President (Haller, Raymond, and Brown)</td>
<td>969 SF</td>
<td>1955-altered significantly</td>
<td></td>
<td><img src="image2.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Ebaugh Res.</td>
<td>930 Robin Rd</td>
<td>Paul and Jean Huesman Ebaugh</td>
<td>Associate Dean of Engineering at PSU</td>
<td>1408 SF (including the 360SF attached garage)- Liv/KIt+ in lower level</td>
<td>1955</td>
<td></td>
<td><img src="image3.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Eakin, Jr. Res.</td>
<td>558 Glenn Rd</td>
<td>James H. and Peggy Eakin, Jr.</td>
<td>Peggy was a member of the Presbyterian Church-taught Sunday School</td>
<td>2054 SF (including the enclosed 243 SF porch)</td>
<td>1955</td>
<td></td>
<td><img src="image4.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Gorlow Res.</td>
<td>622 Franklin Street</td>
<td>Leon and Aviva Gorlow</td>
<td>Prof. of Psychology at PSU</td>
<td>1112 SF (W/O the attached garage)</td>
<td>1955</td>
<td></td>
<td><img src="image5.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Taft Res.</td>
<td>509 Glenn Rd</td>
<td>Dr. Robert Taft, Jr. and Cara</td>
<td>Robert: Prof. of Chemistry Cara: co-founder of one of the first preschool co-ops in State College.</td>
<td>2054 SF (including the enclosed 243 SF porch)</td>
<td>1955</td>
<td></td>
<td><img src="image6.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Name</td>
<td>Address</td>
<td>Original Owner(s)</td>
<td>Owner's Occupation</td>
<td>Orientation-N is up</td>
<td>Main floor area</td>
<td>Const. date</td>
<td>Image</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------</td>
<td>--------------------------</td>
<td>------------------------------------------</td>
<td>--------------------</td>
<td>-----------------</td>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>McDona ld Res.</td>
<td>510 Glenn Rd</td>
<td>Eugene and Marie McDonald</td>
<td>Prof. of Special Education at PSU</td>
<td>2,004 SF</td>
<td></td>
<td>1955</td>
<td></td>
</tr>
<tr>
<td>Corso Res.</td>
<td>1018 Metz Ave</td>
<td>John F. and Josephine Ann Solazzo Corso</td>
<td>Prof of psychology-director of the Human Research Lab at PSU</td>
<td></td>
<td></td>
<td>1955</td>
<td></td>
</tr>
<tr>
<td>Harris Res.</td>
<td>500 Glenn Rd</td>
<td>Brice and Loring S. Harris</td>
<td></td>
<td></td>
<td></td>
<td>1955</td>
<td></td>
</tr>
<tr>
<td>Hansen Res.</td>
<td>517 Glenn Rd</td>
<td>Chadwick C. and Betty Jane Hansen</td>
<td>Prof. of English at PSU</td>
<td></td>
<td></td>
<td>1956</td>
<td></td>
</tr>
<tr>
<td>Christ-Janer Res.</td>
<td>525 Glenn Rd</td>
<td>Albert W. and Virginia Christ-Janer</td>
<td>Dean-Arts and Arch. PSU</td>
<td></td>
<td></td>
<td>1956</td>
<td></td>
</tr>
<tr>
<td>Sommer Res.</td>
<td>533 Glenn Rd</td>
<td>Leo H. and Sally Sommer</td>
<td>Prof pf Chemistry at PSU</td>
<td></td>
<td></td>
<td>1956</td>
<td></td>
</tr>
<tr>
<td>Weber Res.</td>
<td>625 Ridge Ave</td>
<td>Robert and Marion Weber</td>
<td>Prof. of Physics at PSU</td>
<td>1,568 SF</td>
<td></td>
<td>1956</td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Address</td>
<td>Original Owner(s)</td>
<td>Owner's Occupation</td>
<td>Orientation-N is up</td>
<td>Main floor area</td>
<td>Const. date</td>
<td>Image</td>
</tr>
<tr>
<td>------------</td>
<td>------------------</td>
<td>------------------------------------</td>
<td>-----------------------------------------</td>
<td>---------------------</td>
<td>-----------------</td>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>Condee Res.</td>
<td>443 Waring Ave</td>
<td>Ralph J. W. and Norma Condee</td>
<td>Ralph was a Prof. of English Lit at PSU, Norma a translator</td>
<td></td>
<td>2,240 SF</td>
<td>1956</td>
<td><img src="image1.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Walters Res.</td>
<td>526 Glenn Rd</td>
<td>Walter H. and Geraldine Walters</td>
<td>Prof. of Theater at PSU</td>
<td></td>
<td>11,208 SF W/O Garage and Terrace</td>
<td>1957</td>
<td><img src="image2.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Kaufman Res.</td>
<td>534 Glenn Rd</td>
<td>Jacob and Thelma Kaufman</td>
<td>Prof. of Economics at PSU</td>
<td></td>
<td>1,120 SF W/O Garage</td>
<td>1957</td>
<td><img src="image3.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Noyes Res.</td>
<td>542 Glenn Rd</td>
<td>William G. and Maxine Noyes</td>
<td>Prof. of Music Education at PSU</td>
<td></td>
<td>1,142 SF W/O Garage, breezeway and terrace</td>
<td>1957</td>
<td><img src="image4.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Cartey Res.</td>
<td>766 Glenn Rd</td>
<td>James M. and Julia C. Cartey</td>
<td>Architect-Physical plant group at PSU</td>
<td></td>
<td></td>
<td>1957</td>
<td><img src="image5.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Euwema Res.</td>
<td>509 Westview Ave</td>
<td>Ben and Catherine Euwema</td>
<td>Dean of Liberal Arts at PSU</td>
<td></td>
<td>1,138 SF W/O Garage and breezeway/connector, which is currently part of the house.</td>
<td>1957</td>
<td><img src="image6.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Name</td>
<td>Address</td>
<td>Original Owner(s)</td>
<td>Owner's Occupation</td>
<td>Orientation-N is up</td>
<td>Main floor area</td>
<td>Const. date</td>
<td>Image</td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------</td>
<td>-------------------</td>
<td>---------------------------------------------</td>
<td>---------------------</td>
<td>--------------------------</td>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>Gemmel I Res.</td>
<td>953 Robin Rd</td>
<td>James J. and Mary Lou Gemmell</td>
<td>Prof. and Director Economies and Business Education at PSU</td>
<td></td>
<td>1,624 SF W/O the screened porch</td>
<td>1957</td>
<td></td>
</tr>
<tr>
<td>Snowdon Res.</td>
<td>251 South Osmond St.</td>
<td>John C. and Anne J. Snowdon</td>
<td>Research Prof. Penn State's Applied Research Lab</td>
<td></td>
<td>854 SF W/O Garage</td>
<td>1959</td>
<td></td>
</tr>
<tr>
<td>Mackenzie Res.</td>
<td>327 Arbor Way</td>
<td>Ossian and Kyle Mackenzie</td>
<td>Dean-College of Business Admin. At PSU</td>
<td></td>
<td>1,683 SF (W/O carport, porch and yard)</td>
<td>1959</td>
<td></td>
</tr>
<tr>
<td>Duke Res.</td>
<td>258 South Osmond St.</td>
<td>Charles and Helen S. Duke</td>
<td>Vice president with HRB-Singer</td>
<td></td>
<td>826 SF (only one floor)</td>
<td>1960</td>
<td></td>
</tr>
<tr>
<td>Hajjar II Res.</td>
<td>949 Robin Rd</td>
<td>A. William and Anne Bortz Hajjar</td>
<td>Architect-Prof. of arch. at PSU</td>
<td></td>
<td></td>
<td>1961</td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Address</td>
<td>Original Owner(s)</td>
<td>Owner’s Occupation</td>
<td>Orientation-N is up</td>
<td>Main floor area</td>
<td>Const. date</td>
<td>Image</td>
</tr>
<tr>
<td>------------</td>
<td>------------------</td>
<td>-------------------</td>
<td>---------------------------------------------------------</td>
<td>---------------------</td>
<td>-----------------</td>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>Herzog Res.</td>
<td>257 South Osmond St.</td>
<td>Leonard and Lisa Herzog</td>
<td>Prof of Geochemistry and Geophysics at PSU</td>
<td>800 SF</td>
<td></td>
<td>1961</td>
<td></td>
</tr>
<tr>
<td>Ferrell Res.</td>
<td>269 South Osmond St.</td>
<td>Otis G. and Patricia A. Ferrell</td>
<td>Patricia was a Prof of Health and Human Develop. At PSU</td>
<td>1,124 SF W/O Garage</td>
<td></td>
<td>1962</td>
<td></td>
</tr>
</tbody>
</table>
MAHYAR HADIGHI

EDUCATION

Ph.D. Candidate (Expected August 2020), The Pennsylvania State University

M.A. in Historic Preservation Planning (2014), Cornell University

M. Arch (2007), Azad University of Tehran

ACADEMIC POSITIONS

Texas Tech University, College of Architecture: Assistant Professor (2019–present)

Penn State University, Department of Architecture: Instructor (2018–2019)

Penn State University, Department of Architecture: Teaching Assistant (2015–2018)

Virginia Commonwealth University, School of Government and Public Affairs: Instructor (2014)

James Madison University, Department of Foreign Languages, Literatures, and Cultures and Department of Art History: Instructor (2012–2013)

Cornell University, Department of City and Regional Planning: Teaching Assistant (2010–2012)

Marlik University, Department of Architecture: Assistant Professor (2008–2010)

SELECTED ACADEMIC AWARDS

Iranian American Academics and Professionals Student Scholarship Award for contributions to the field of architecture (2018)

Penn State Graduate Exhibition Award: First place in arts and humanities (2018)

Excellence in Leadership Award, Pennsylvania State University Student Engagement Programs (2017)

Alma Heinz and August Louis Pohland Graduate Fellowship (2015)

Constructed Environment Graduate Scholar Award (2014)


SELECTED PUBLICATIONS


