WHAT IF? WHAT NEXT?

SPECULATIONS ON HISTORY'S FUTURES

SESSION 1A

MODES OF ARCHITECTURAL HISTORY

Ecologies of History: Histories of Ecology

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SEQUENCING SQUARE: A STUDY OF PATTERNS IN THE PLAN DRAWINGS OF PETER MULLER

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This paper analyses architect Peter Muller's composition techniques by diagramming plan drawings of the Walcott house (1955) and Walker house (1958). Previous studies of Muller's work have focused primarily on descriptive devices, whereas this research demonstrates how he employed patterns of alignment to arrange primary shapes into geometric relationships. Two types of diagrams are used for this purpose; first, the geometric diagrams, drawn over the plan drawings and second, the computational diagrams coded with two-dimensional cellular automata. These diagrams are aligned with the plan using 'outlines', 'grid lines', 'trace lines' and sometimes the 'implied lines' suggested by geometric construction/rules of quadrature. The implication of using cellular automata for the study of plan composition is based on their capability of emergent behaviour over different generations/time-steps. The geometric diagram of a plan is mutated into various diagrams in the rule-space of a cellular automaton and creates a matrix of ideological diagrams. Additionally, in comparing the pattern system used in Peter Muller's drawings with that in Frank Lloyd Wright's work, this study provides new insights on Muller's artistic debt to latter. Thus, cellular automata plots are used as a 'schema' to study plan drawings of Muller and as a 'double schema' to study the connection/influence of Wrightian philosophy on them. In revealing the underlying patterns in plan drawings, this study contributes to a refreshed and novel perspective of Peter Muller's work and advances our understanding of the role of patterns in architectural production.

Introduction

Peter Muller (b. 1927), a key proponent of site-specific organic architecture, established his architectural practice in 1952, in Sydney. His work grants a parallel narrative to the conventional modern movement, sympathetic to the work of architect Frank Lloyd Wright. Muller's earlier domestic architecture (1952-1964) exhibits a strong sense of geometric composition and axial alignment. One of the compositional strategies used by him is the interlocking of rotated squares along orthogonal axis with the implied use of cruciform in the roof plan. This article demonstrates how this organizational pattern works by analyzing the plan drawings of Walcott House (1955) and Walker House (1958). It also traces the source of its influence to the cruciform of the Prairie period and the rotational geometry of Wright's unbuilt projects in California, particularly the summer colony of Lake Tahoe (1923).

Earlier studies have been enthralled by the visual characteristics of Peter Muller's architecture, the integration of site features and the use of natural materials. The specific issue of linkage between Frank Lloyd Wright and Muller's work has also drawn comment from architectural historians and critics. For example, Jennifer Taylor in "An Australian Identity: Houses for Sydney 1953-63" (1984) identified the two early houses of Peter Muller, the Audette House at Castlecrag (1953) and the Whale Beach House (1955) inspired by the 'Organic' approach of Frank Lloyd Wright, declaring the "sweeping horizontals" and "interpenetrating volumes" as a "new phenomena". She also praised the innovative use of natural materials and established the influence of Asian philosophy on his architecture.[1] Philip Drew termed Muller as the leading romantic figure in the Australian post-war architecture perusing an "organic" ideal "in a mystical union with nature". He also observed a strong sense of geometry in Muller's work with a "pervasive unity of form" and "repetition of simple geometric elements".[2] J.C. Urford argued that Muller's architecture has played "a crucial role in the establishment of an indigenous Sydney and Australian architecture".[3] However, few have discussed the role of patterns in Peter Muller's plan drawings, then use it as an analytical device to establish Wrightian influence on his early work and this study will deal with that topic.

In order to acknowledge the transfer of plan making techniques between the work of Muller and Wright, a methodology of comparative diagramming is developed using geometric diagrams and cellular automata generative system. Cellular automata, introduced by Von Neuman (1951) and developed by Stanislaw Ulam (1962), is a computational method that heralds on the idea of growth by stimulating a complex system using simple rules. The code for two-dimensional, nine-neighbourhood cellular automata is a given source by Wolfram research that is used to create plots analogous with plan geometries. However, it should be noted that this study is not a mathematical or statistical analysis of plan drawings; neither is it intended to generate exact copies of plans, rather a parti or schema to help understand the compositional grammar of the plan.

Peter Muller and the Organic Ideals

Peter Muller, born in 1927, studied at the University of Adelaide, graduating with a Bachelor of Engineering degree and a fellowship in Architecture in 1948. In a personal statement in 2014, he termed his architectural education as a "practical hands-on experience" which he thinks is lacking in architectural schools today.[4] Muller was the first Australian architect to win the prestigious Fulbright scholarship, studying architecture at the University of Pennsylvania in 1951/52. On his return, he started his private practice in Sydney in 1952.

Muller was interested in music, metaphysics and believed his work to be "site-specific" and "not much of a functionalist".[5] In an interview with Sydney Museum, Muller agreed that in the early days, the work of Frank Lloyd Wright did strike him like a chord of good music.[6] Perhaps, young Muller turned to Wright for the practical apparatus to turn his dreams into reality, as argued by Taylor in her seminal work *An Australian identity: houses for Sydney 1953-1963 (1984)*. Part of the answer lies in Muller's own portfolio, published in the 1955 issue of *Architecture and Arts*,

featuring his most recent schemes with the commentary that "Muller's work is in the style of the American architect Frank Lloyd Wright" and "he is the second architect to interpret Organic architecture in its true sense in Australia, the first one being Walter Burley Griffin".[7] It was heavily illustrated with his perspective drawings influenced by Wright's renderings. Only two plans were published: his own house at Whale Beach and the Walcott House. Both featured cross-axial geometry of 'Prairie style' houses in slightly different configuration.

"HOUSE OF THE YEAR" AWARD TO HOLIDAY HOME

● On this and following pages we present the house which "Architecture and Arts" selected from 10 finalists as the best of the year. The panel of judges say it is a remarkable example of modern Australian architecture, with complete harmony between landscape and building.

THE winner of the award is Sydney architect Peter Muller, who designed it as a holiday retreat for Mr. and Mrs. Anthony Walcott, of Bombala, N.S.W., and their two young children.

Built on a level plateau below scenic Bynya Road (only a few minutes' drive from Palm Beach, N.S.W.), the house covers an area of 10½ squares (1050 sq. ft.), with an additional six squares (600 sq. ft.) of covered area for carport, barbecue terrace, and general outdoor living.

judges chose this one from nine others which reached the finals. Six were built in Victoria, one in Perth, and two in New South Wales.

A spokesman for the award panel said that while Mr. Muller's design used principles frequently employed by the great American architect Frank Lloyd Wright, the house itself had many striking original features, both in plan and elevation, and was most suited to Australian conditions.

"The space in and around the house has been sculpted in a masterful manner, providing a truly delightful place for

terials as an artist uses his paint, where all elements are related."

A glance at the plan and the picture above will show that the house is divided into separate units—living and sleeping—connected only by a covered walk.

This was done not only to create an atmosphere of holiday living but, more important still with young children in the picture, to separate completely the sleeping area from the noise of general living and of entertaining.

The block devoted to general living is simply one large room with a cleverly

PLAN of the "House of the Year" shows the diamond-shaped form of the separated living and sleeping blocks and outdoor living area. Dotted lines show formation of crossed roof structure. Compare the picture of the house (above) and those shown in color overleaf with the plan below.

Figure 1. Walcott house as 'House of the Year' by 'Architecture and Arts'. Source: *The Australian Women's Weekly*, July 17, 1957.

Figure 2. Walker House (1958). Source: Peter Muller by Jacqueline C. Urford.

In the editorial of the same issue, Muller pleaded to return to 'Nature' in order to seek the 'Great Truth' to be found in its stylistic perfection and the inherited capacity of accommodating functional needs. He also advocated the connection between arts and creativity; "Be not ashamed to be influenced by works of art. They may lead to an earlier understanding of principles and so release us even from the influence".[8] Once published, Muller sent a copy of this magazine to Wright at Taliesin and received a generous reply in March 1956 with an invitation to see him sometimes in the future. During his studies in America, however, he never got a chance to visit any of the Wright's buildings. Taylor suggested that, "it was the compatibility of Wright's theories on building with his own developed ideas that attracted Muller".[9]

The Audette House (1953) which was Muller's first built project, was declared by Philip Goad to be one of the first most convincingly Wrightian houses to be built in Australia.[10] He proposed that the overlapping single room width wings, floating roofs, outrigger beams and emphatic horizontality recalled Wright's Taliesin West. Subsequently, Muller's own house at Whale Beach house (1954), a structural concept of individual piers carrying trusses, implied a close connection with nature and features of the site, resonating with Wright's theory of organic growth. Both Audette House and Whale Beach House used simple rectangular geometry along varied axes. In contrast, the Walcott house (1955) embraced a rotated square configuration in a segmented cruciform plan, with the outward sloping walls for the children's bedrooms and ribbon like continuous clerestory windows to reduce the scale of the house to a more human level. Walcott House was awarded 'House of the Year', by *Architecture and Arts* in 1957 (Fig. 1). One of the judging panel said, "while Muller's design used design principles frequently employed by Frank Lloyd Wright, it had many original features both in plan and elevation, and it is most suited to Australian conditions".[11] In 1958, Muller designed the Walker House, which used a simplified version of cross axial geometric construction (Fig. 2).

Geometric Patterns in Muller's Plan Forms

Muller's plan forms have a strong axial configuration using simple geometric forms. The study of plans like Walcott house and Walker house shows the prevalence of the square as the primary compositional element. It seems highly likely that he modified these plan forms according to the geometric construction of 'quadrature'. A quadrate refers to the making of the square or anything contained within a square. One geometric system is the square root of two progression, known as 'ad quadratum', constructed by joining the midpoint of the sides of a square. While, another possibility is the rotating of square about its axis. In plan, this geometric relationship can inform the design process, in which one square is rotated and superimposed on another, or the rotation itself defines secondary and tertiary set of forms. Even the axial inflection of the cruciform plan is implied by rotating the square on itself and subtracting triangular areas from it.

The plan of the Walcott house is an in-line composition of two separate units, living and sleeping, connected by a covered walkway. Urford considered the plan as having "two matching elements: one male and other female" like "two squares pulled apart". She believed that the "pulled apart functions create an expressive, romantic organic building".[12] The two halves of the plan have a distinctive geometric composition, but are then orthogonally intertwined. The rotated square (A) of the living area has an implied geometric progression with a linear factor of $\sqrt{2}$, also known as 'ad quadratum'. The next square (B) is constructed by joining the corners of living room square (A) and rotating it at 90 degrees about its axis and marks the outer prow-like alcove, inclosing the kitchen and the entry walkway to the house. Following the same instructions, the next square (C) is constructed by linking the corners of square (B) and rotating it at 90 degrees. The square (C) then outlines the outdoor barbeque area that is visually extended from the living area, the V-shaped column of the carport and the entrance vestibule to the bedroom unit. The rotated square of the bedroom unit (D), with one master bed and two children's bedrooms, is divided into four quarters. One of the quarters (E) is expanded along the longitudinal axis to interlock orthogonally with the living area. Now, the roof plan is a pure cruciform with triangular ends, however, the transverse axis is lower is height and the longitudinal axis routes over it, accommodating the clearstory windows throughout its length (Fig. 3).

The plan of the Walker house is a simple cruciform, contained within the geometric construction of a square rotated on itself (F). The rotated square has left its mark in the outer pavement of the house. Both ends of the cruciform are triangular and sloping inwards, also implying the interlocked geometry of two rotated squares (F, G). Another way of looking at the plan geometry is its generation from the 'square units'. Overall, it can be concluded that the reviewed plan forms are derived from the geometric interaction of square, in varied orthogonal and diagonal axes (Fig. 4).

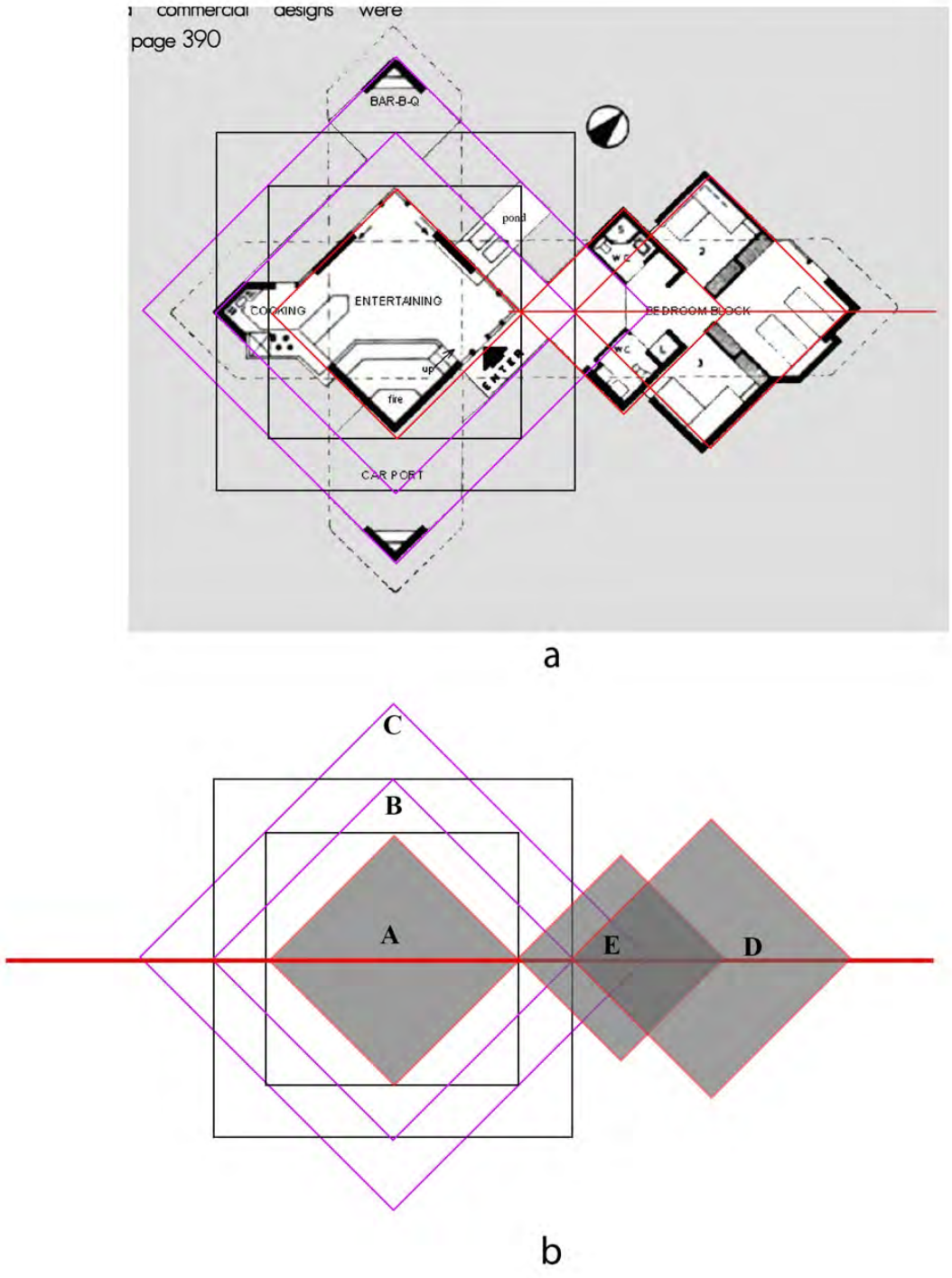

Figure 3. Walcott House (1955): (a) Plan of Walcott house with lines of geometric construction, here red color codes for primary geometric shapes of the composition, black are the construction lines and purple are the implied geometry suggested by the rules of quadrature; (b) Geometric diagram of Walcott house.

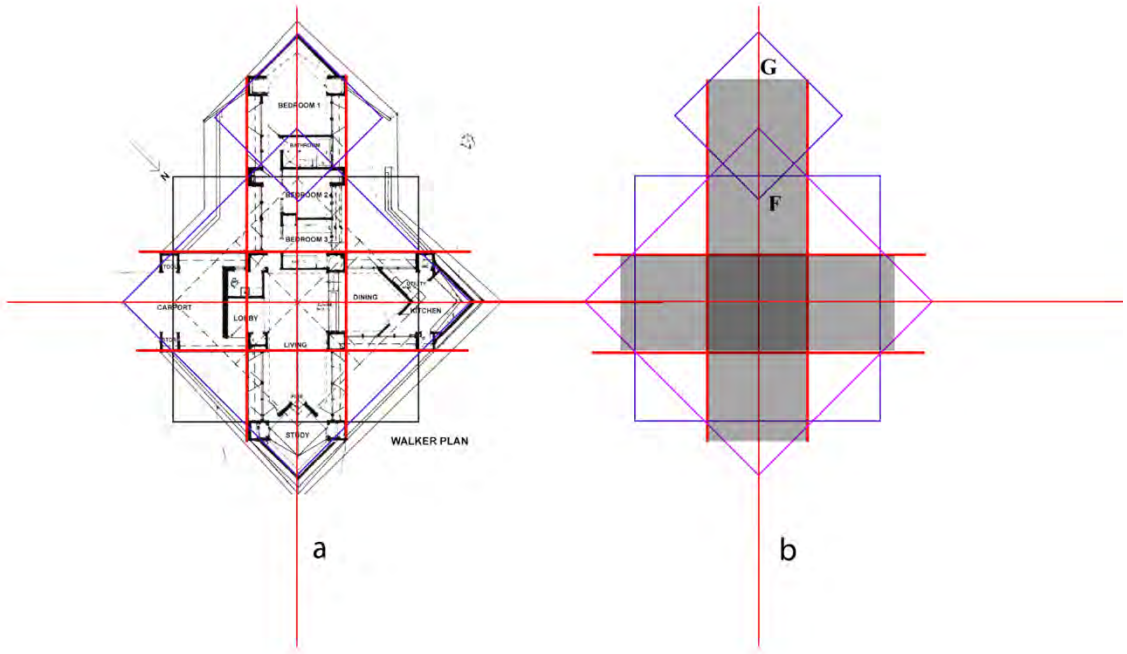

Figure 4. Walker House (1958): (a) Plan of Walker house with lines of geometric construction, here red color codes for primary geometric shapes of the composition, black are the construction lines and purple are the implied geometry suggested by the rules of quadrature; (b) Geometric diagram of Walcott house.

Cellular Automata Generation Methods

Cellular Automata are mathematic concepts that produce patterns with rich morphological behaviour. A study of two-dimensional cellular automata with simple initial conditions has resulted in a formal grammar of primary shapes in multiple overlays. The geometry of patterns formed by these cellular automata are capable of direct comparison with the geometric configurations of architecture plan forms. By definition, a cellular automaton consists of a regular grid of cells, where each cell takes on a possible value that is updated in discrete time steps according to a rule number. Cellular Automata (CA) are comprised of several possible lattices and neighbourhood structures. This paper considers a nine-neighbour square structure (Moore Neighbourhood) with outer totalistic rules, while the algorithm used is a given source by Wolfram Research.

In the early 1950s, mathematician John Von Neumann (190-1957) was working with the idea of machines that make machines more complex than itself. Neumann believed that such machines are possible but impractical to build with the technology in hand. On the other hand, Stanislaw M. Ulam (1909-1984) liked to invent pattern games for computers. He found the growth of patterns to defy analysis. Ulam's games were 'cellular' games played on limitless checkerboards. All growth of patterns took place in discrete jumps and the fate of a cell depended on the states of its neighbouring cells.[13] Ulam suggested Neuman to construct an abstract universe for his analysis of machine reproduction. Later, John Conway in 1970 devised 'game of life' using simple rules of cellular automata (CA). Steven Wolfram in early 1980s developed a sophisticated program (*Mathematica* 1.0 was released in June 23, 1988) for large sequential computation of cellular automata in pursuit to model systems found in nature whose behaviour is complex.[14] More recently, Cellular Automata systems have found applications in image processing and study of patterns with high level of accuracy; for example, Sabetfard (2019) has generated square Kufic scripts using cellular automata algorithm, considering ornamentation as a pure visual pattern.[15]

In an operative sense, the proposed methodology has three levels, defined as abstraction, analysis, and comparison. The first level reduces or abstracts a plan into its basic geometric

shapes, the connections between them and the major or minor axis of composition. The resulting set of connected modules is called a geometric diagram. Then, the topological properties of the diagram are examined visually, the main growth centres or nodes are identified, and overlayed on the geometric diagram of the plan. Consequently, these nodes are used to plant seeds in the cellular automata space. In the second level, the code for the cellular automata is run and the resulting patterns are used to interpret the geometry of the plan. Graphically, one or two patterns, which are closely related to the plan composition, are overlayed on the geometric diagram of the plan.

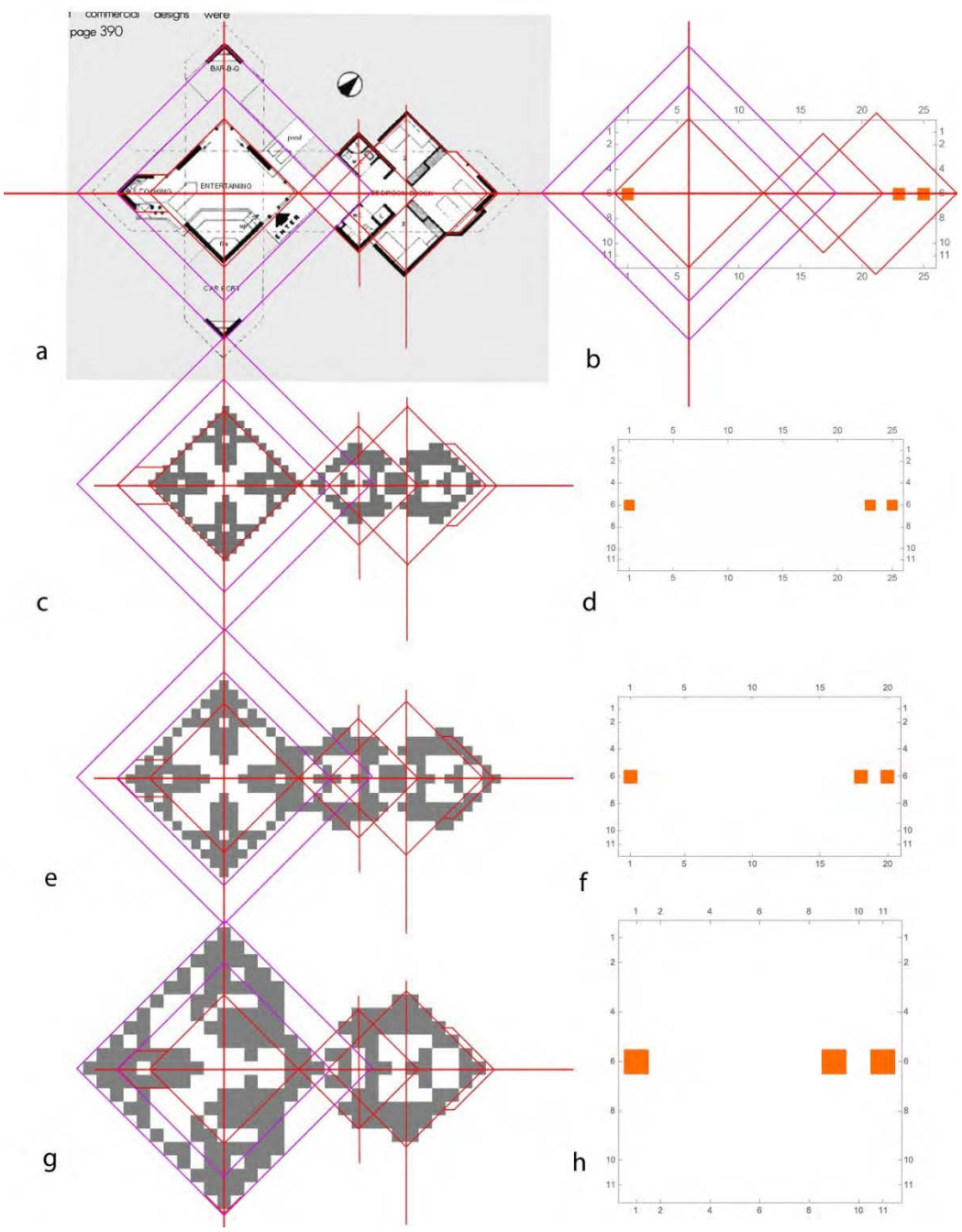

Figure 6. Walcott House (1955): (a) Plan with geometric overlay; (b) Plan geometry with CA Matrix Plot overlay; (c) Plan geometry with CA overlap 1 (rule 109); (d) CA Matrix Plot 1; (e) Plan geometry with CA overlap 2 (rule 109); (f) CA Matrix Plot 2; (g) Plan geometry with CA overlap 2 (rule 109); (h) CA Matrix Plot 3.

The reason for selecting the Wolfram code is the resultant square and diamond shaped patterns which are used as building blocks to generate schema for the plan drawings. The number of possible rules is 2^{10}=1024. With some rules, simple seeds die out, leaving the null configuration, while others produce a growing pattern. For the purpose of this study, a 'Sparse Matrix' initialization is used in a virtual space of 1s and 0s. The black cells {1} are placed at specific positions on a background of white cells {1}, to grow/update over time. Once the seeds are placed and the code is run, a matrix of 1024 ideological diagrams are produced. The plot for rule 109 at time step (t=10) is a rotated square with marked diagonals. Since, we are studying the rotated geometry of Muller's plans, it makes the rule 109 as the preferred choice to be used for the reconstruction of parti or schema.

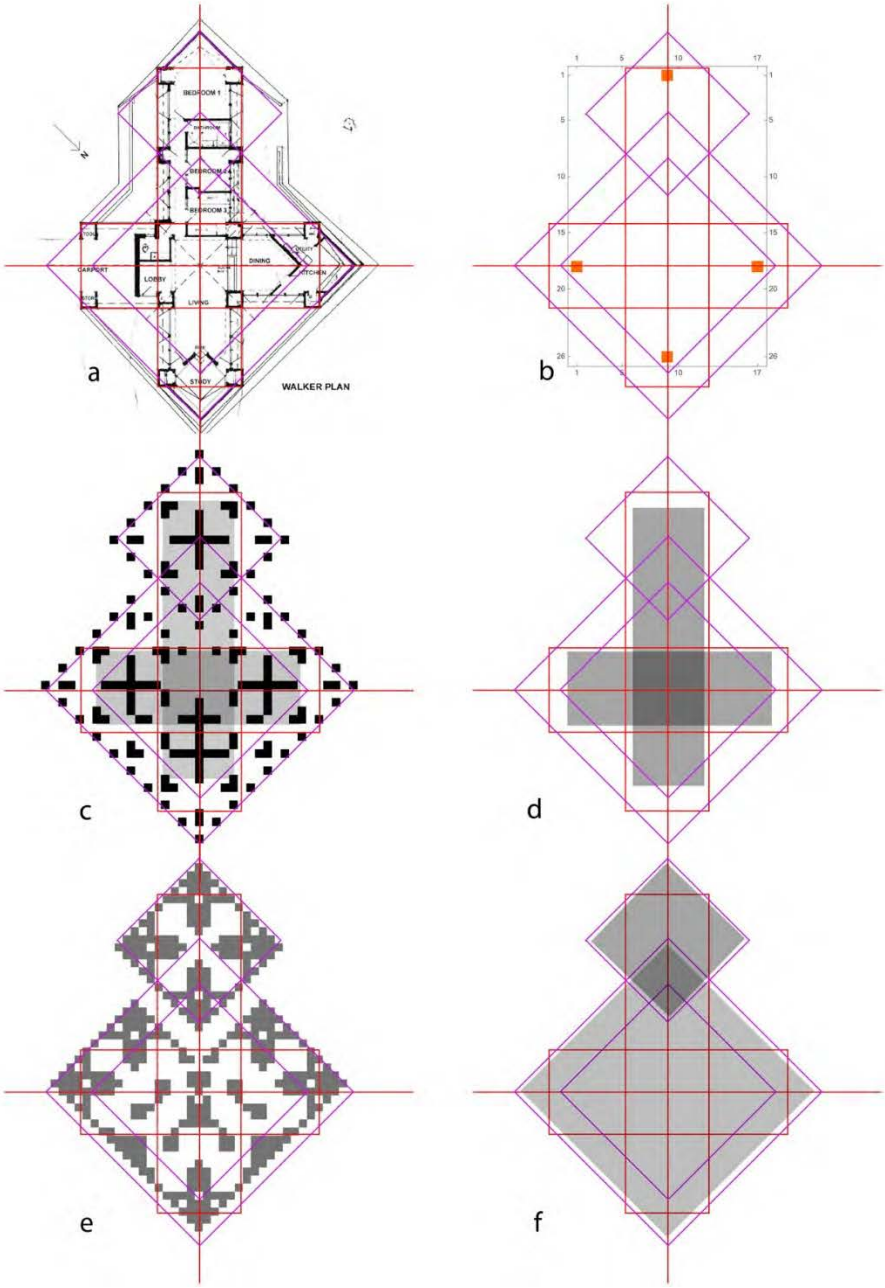

Figure 7. Walker House (1958): (a) Plan with geometric overlay; (b) Plan geometry with CA Matrix Plot overlay; (c) Plan geometry with CA plot 1 (rule 81); (d) Plan geometry with CA geometry 1; (e) Plan geometry with CA plot 2 (rule 109); (f) Plan geometry with CA geometry 2.

In the case of Walcott house plan, an 11 x 25 matrix space is used, where three black cells are placed at {6,1}, {6,23} and {6,25} to interact in a horizontal linear construction. The positioning of these seed cells is in accordance with the geometric location of squares A, E and D in the plan drawing. The CA plot for rule 109 is then aligned with the geometry of the plan. The geometric lines used for the alignment of CA plots and plan drawings are the 'outlines', 'grid lines' and the 'implied lines' suggested by the rules of quadrature. Now, if we alter the distance between the cells in the sparse matrix, we can align the resultant pattern with either square A, B or C, which gives us three slightly varied 'parti' diagrams to study (Fig. 6). While for the Walker house plan, a 26 x 17 matrix space is set up and black cells are allocated at {18,1}, {1,9}, {26,9} and {18,17} for a cross-axial interaction, in correspondence to the position of the four squares units in the plan. Here, we have two possible matches with the geometry of the plan. The CA plot for rule 81 marks the cruciform and at the same time outlines the rotated squares (F, G); while rule 109 only frames the implied rotated geometry of the plan drawing (Fig. 7).

Comparison with Wright's Geometric Forms

The square was used as a basic unit in the Prairie period, organised along main axes or cross axes to maintain an overall balance of space. Robert McCarter, in studying the composition of Wright's plans, argues that these are "constructed of individually articulated geometric shapes, held within a larger square, of which they are understood as subdivisions".[16] There was a strong emphasis on orthogonal geometry during Wright's early career. Diagonality was either confined to ornamentation or the use of bay windows or polygons attached to squares or rectangles. The rotated geometry of the square, encompassing the entire composition was a phenomenon that happened during the year 1923 when Wright designed a series of visionary projects in California including Doheny Ranch Development, Little Dipper Community Centre and Lake Tahoe Resort. Muller's approach appears to emanate from the geometry of both periods, engaging square geometries in orthogonal as well as diagonal configurations.

Muller never visited any of Wright's buildings during his studies in America, but numerous books and articles were published on and by Frank Lloyd Wright in the period between 1945 and 1960. In 1942, Henry-Russell Hitchcock's *In the nature of Materials 1887-1941* was published, offering a comprehensive catalogue of Wright's work. Bruno Zevi's *Towards an Organic Architecture* was published in 1950 which promoted organic architecture in Italy along with the promotion of Wright's philosophy as the "new architecture" of the modern world. Frank Lloyd Wright's autobiography was also reissued in 1946. Other highly influential books published by Wright were *The Future of Architecture* (1953), *The Natural House* (1954) and *A Testament* (1957). *Architectural Forum*, a Boston based magazine circulated three dedicated issues on Wright, 1938, 1948 and 1959. Apart from international recognition, there were local Australian magazines like *Building*, published from New South Wales and *Architecture and Arts* from Melbourne, providing extensive media coverage of Wright's work. Muller seems to have had knowledge of these publications, which introduced him to Frank Lloyd Wright and prompted a serious investigation into his philosophy and practice.

The Ward Willits House (1902-03) from Wright's early Prairie period used a triangular bay window as terminal to the main axis of the house, while a cross axis projects the interior space in the other direction. Nonetheless, the dynamic articulation of this plan is overlaid by the secondary, rather static roof configuration. This is the same arrangement of the living area of the Walcott house where the main axis of the house has a triangular alcove on one end, while the cross-axis is extended visually through the glass doors to the outdoor B.B.Q area. If we ignore the visual extension of this axis in the plan, it makes its reference to the in-line plan of the Robie House (1907-10) that culminated in Wright's use of a triangular bay on both ends to extend the spatial axes to a 'single room type' dwelling. The River Forest Tennis Club (1906) however, used the triangular protrusion as a solid mass rather than window openings as in the case of both Walcott House and Walker House. The plan of Walker House is cruciform, referencing a typical Prairie period plan with two wings interpenetrating each other to form a stable square in the centre. Also,

the roof plans of the Prairie period are mostly cross-axial in two levels and both of the Muller projects under study have cruciform roof plans with difference in height levels.

Another project of interest is the Doheny Ranch project (1923) which was a residential development of a grander scale located at the base of the Santa Monica Mountains. Three houses were designed in detail, labelled by Wright as House A, House B and House C. House A and B have a more formal expression with the central dominant square volume rising up and extending down to the ground. The design of House C continues this pattern except for the projection of the terrace on the front with the angled walls of the house rising behind. It is based on the geometry of a rotated square or 'ad quadratum'. The diagonal inclination was further explored in the Community Playhouse, the Little Dipper, Olive Hill (1923), which incorporated interlocking cross-axial diagonal composition. The plan consists of a square schoolroom/theater, oriented on its diagonals with a stage on one corner and circular outdoor seating on the other. The project was also published in the 1938 issue of *Architectural Forum*. Another unbuilt project of this period was the Summer Colony at Lake Tahoe (1923) where Wright designed a series of floating villas. The simplest form was the Wigwam with a plan based on two squares, rotated on one another, while the square units along the longitudinal axis are stretched out, putting emphasize on the y-axis. Muller sharply observed that a combination of orthogonal and diagonal geometries creates more magnificent sense of space. The Walcott House seems to draw its base geometry from the cruciform of the Prairie period, replacing the rectangular areas with the rotated squares. If we consider the rotated square of the living room as an independent unit, it resembles the ad quadratum of House C of the Doheny Ranch project, while the bedroom unit draws its geometric reference from the square quarters of the Lake Tahoe villas (Fig. 8).

The Schema of CA

Consider the Sparse Matrix for Walker House, which consists of four cells in cross axial arrangement. The horizontal axis is symmetrical, while the vertical axis is slightly elongated. Three units down and it conforms to a perfect biaxial symmetry; if we continue to slide down, say eight units from (1,9) to (9,9), it imitates the squat cruciform of Wright's Martin House (Fig. 9). While in case of the Walcott House, if we reduce the number of cells in CA to two and move these within a proximity of fifteen units, it resembles the implied rotated geometry of the Robie House (Fig. 10). However, the Walcott geometry is more of a hybrid composition taking reference from the rotated geometries of Wright's later period. If we study the CA diagram for the Lake Tahoe 'Big Tree' cabin, it is one square divided into quarters, while the two quarters are elongated vertically (Fig. 11). It is the same case as of the bedroom unit of the Walcott House, which has internal divisions as quarters of the square, with one quarter enlarged and pulled out at the corner. Muller could have acquired this technique by studying Wright's principles of rotated geometry.

Conclusion

In Australia, the post-war period was a time to search for identity in Australian architecture and Wright's philosophy appealed to Peter Muller, perhaps due to its humanistic and regional characteristics. Specifically, during the 1950s and early 1960s, the geometric connection with Wright's work was stronger, marked with the execution of the Audette House, Walcott House, and later Walker House. Though Wright seldom talked about his composition techniques, Alan Colquhoun observed that "the plans exhibit a geometric order which stems from Beaux-Arts" which suggests organization along grids and axial arrangements.[17] A similar extension of this approach can be seen in Muller's work. Working through the computational and geometric diagrams of Muller's and Wright's projects, it is illustrated that both of their plan forms are variations of cross-axial geometry using square and rotated square as a basic unit. There may be differences in the scale of the modular units or spacing of the grid lines, but they share the same pattern system or rules of composition.

This paper has presented an exploratory study of two-dimensional cellular automata as a tool for formal analysis of architectural drawings. It is not argued that the principle of cellular automata

explains it all, though it does provide an interesting analogy between an architectural plan and emergent computation. The approach is largely speculative in character: typical initial conditions are chosen, seeds are placed, and their evolution is studied by plotting the given code. The generated patterns provide an ideological extension of the schema of the plan. To make the CA plots look more similar to the plan drawings, new rules could be added to the given algorithm. Additionally, machine learning tools could be used to find the best match for the plan composition. One of the limitations of the CA analysis is its validation through trial and error; by comparing multiple CA plots until one elusively looks like the target.

While Frank Lloyd Wright's quadrate formations have been studied extensively, it is their appropriation to Australian context that is reviewed, only to find out that the influence is deeply rooted in the formal techniques of plan-making. By verifying a relation between form and technique using both the geometric diagram and the emergent diagram of cellular automata, the study demonstrates how similar Muller's planning is to Wright's, despite Muller's apparent emphasis on architecture that is driven by a response to site and topography. The study emphasized Muller's skill in adapting Wrightian geometries to Australian climate and is part of a broader analysis of Wright's influence on post-war modernism in Australia.

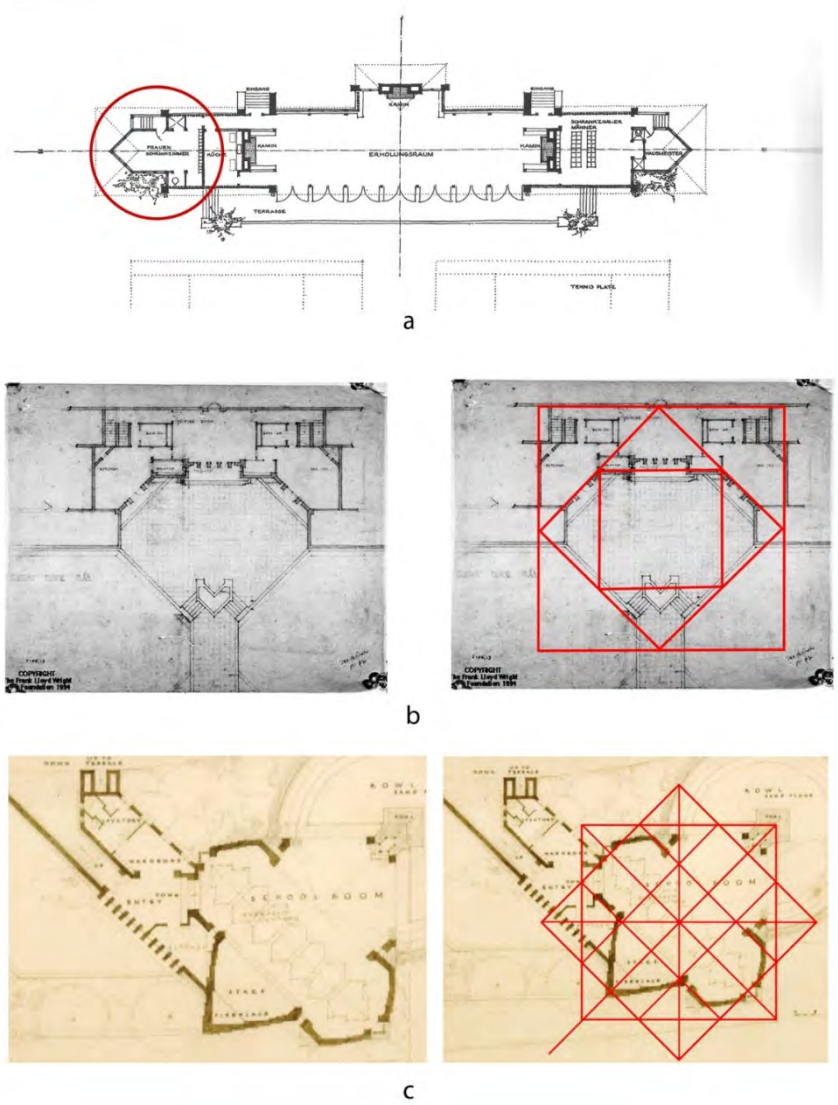

Figure 8. Geometric patterns in Frank Lloyd Wright's projects: (a) River Forest Tennis Club (1906); (b) Doheny Ranch Development, Plan for House 'C' (1923); (c) Little Dipper Community Center, Olive Hill, (1923).

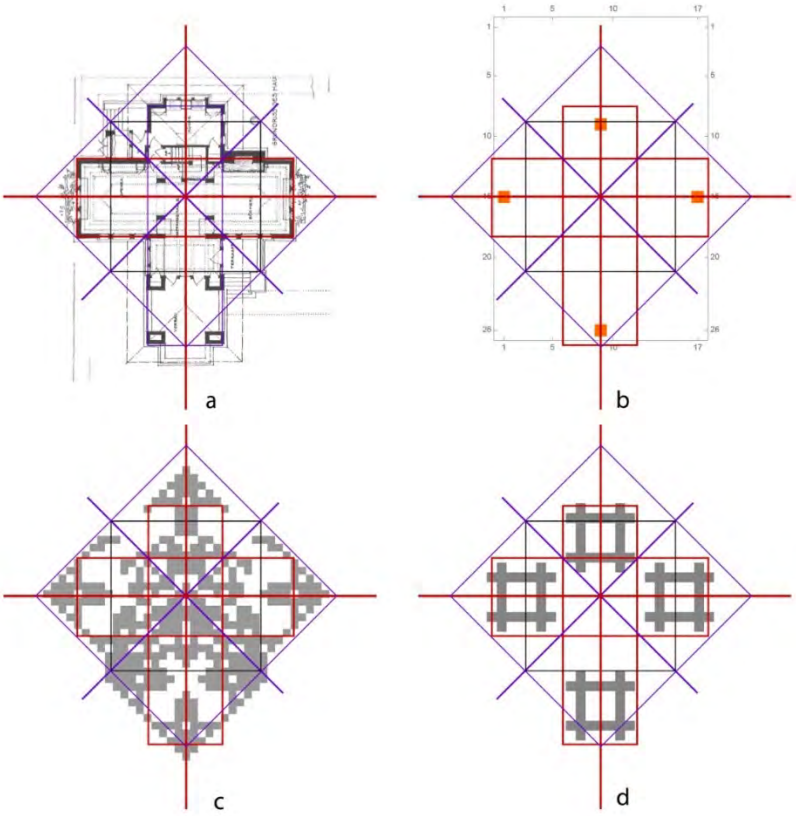

Figure 9. Martin House (1905): (a) Plan with geometric overlay: (b) Plan geometry with CA Matrix Plot overlay: (c) Plan geometry with CA plot overlay 1 (rule 109): (d) Plan geometry with CA plot overlay 2 (rule 25).

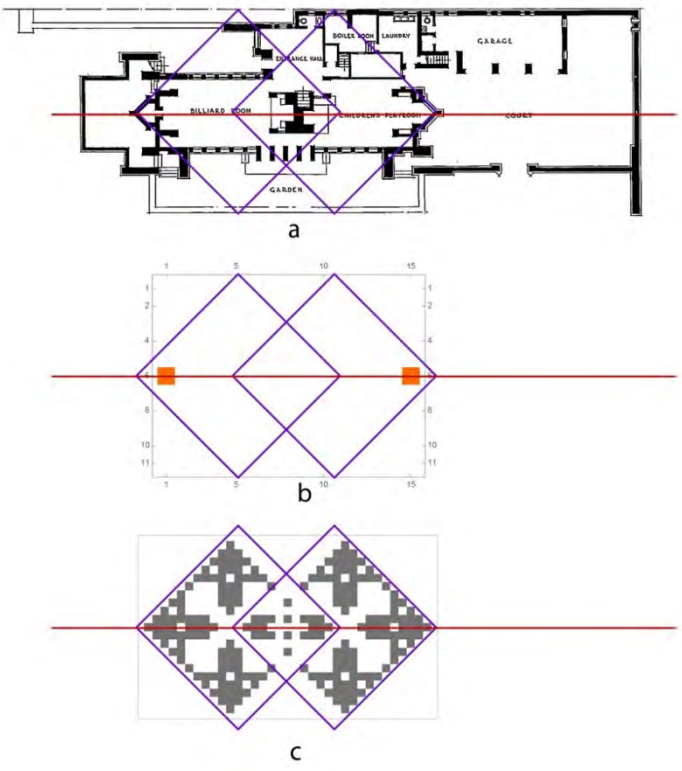

Figure 10. Robie House (1909): (a) Plan with geometric overlay; (b) Plan geometry with CA Matrix Plot overlay; (c) Plan geometry with CA plot overlay (rule 109).

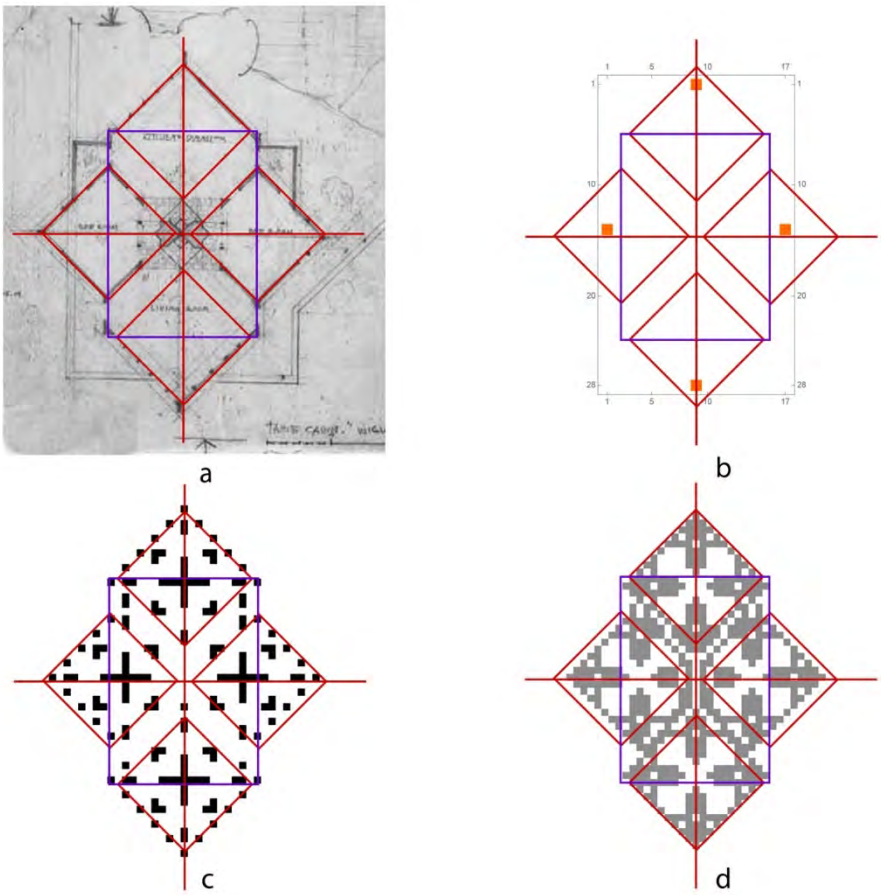

Figure 11. Lake Tahoe Resort, Big Tree Cabin (1923): (a) Plan with geometric overlay; (b) Plan geometry with CA Matrix Plot overlay; (c) Plan geometry with CA plot overlay 1 (rule 81); (d) Plan geometry with CA plot overlay 2 (rule 109).

Endnotes

[1] Jennifer Taylor, *An Australian identity : houses for Sydney 1953-1963*, 2nd ed. (Sydney : Dept. of Architecture, University of Sydney, 1984).

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