the baltimore rowhouse grammar
supported by CERL

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PILOT: Predicting Interior Layouts Over building Types

overview

- Baltimore Rowhouses

  - Scope of the Corpus

  - Common Patterns

- Shape Grammars

- The Rowhouse Grammar

  - Conventions and Assumptions

  - Grammar Rules

- Example: Riddell-Carroll House

- Further Work

baltimore rowhouses

- **defined**
  - **typical working-class residence, built ca. 1780-1890**
  - exemplified by Baltimore's Federal Hill neighborhood
    - declared a National Register Historic District in 1970
  - federal, Greek revival and Italianate styles

- **major sources**
  - Heywood ME. 1981. "Urban Vernacular Architecture in Nineteenth-Century Baltimore." Winterthur Portfolio 16(1). 33-63.
  - Heywood ME, Belfoure C. 2002. The Baltimore Rowhouse. New York: Princeton Architectural Press.
  - Hayward ME, Shivers FR. 2004. The Architecture of Baltimore: An Illustrated History. Baltimore: Johns Hopkins UP.

scope of the corpus

- focusing specifically on vernacular rowhouses

- reasons for excluding contemporary rowhouses

  - traditional rowhouses form a fairly distinct class

  - contemporary rowhouses diverge significantly from vernacular forms; conflating them with traditional rowhouses would produce a less coherent grammar

  - some new rowhouses may be added to this grammar; others may require a separate grammar

common patterns

- **two or three blocks deep**
  - front: parlor, bedrooms (upstairs), stairway, dining room, hallway
  - back: kitchen, dining room, auxiliary rooms
  - middle: hallway, stairway, pantry
- **two or three bays wide**
  - bays are defined by front windows and doors
  - three bays: front hallway; two bays: no hallway
- **one or two spaces deep**
  - both front and back blocks
- **block orientations**
  - blocks may be mirrored in various ways
- **various staircase, fireplace, window and door patterns**
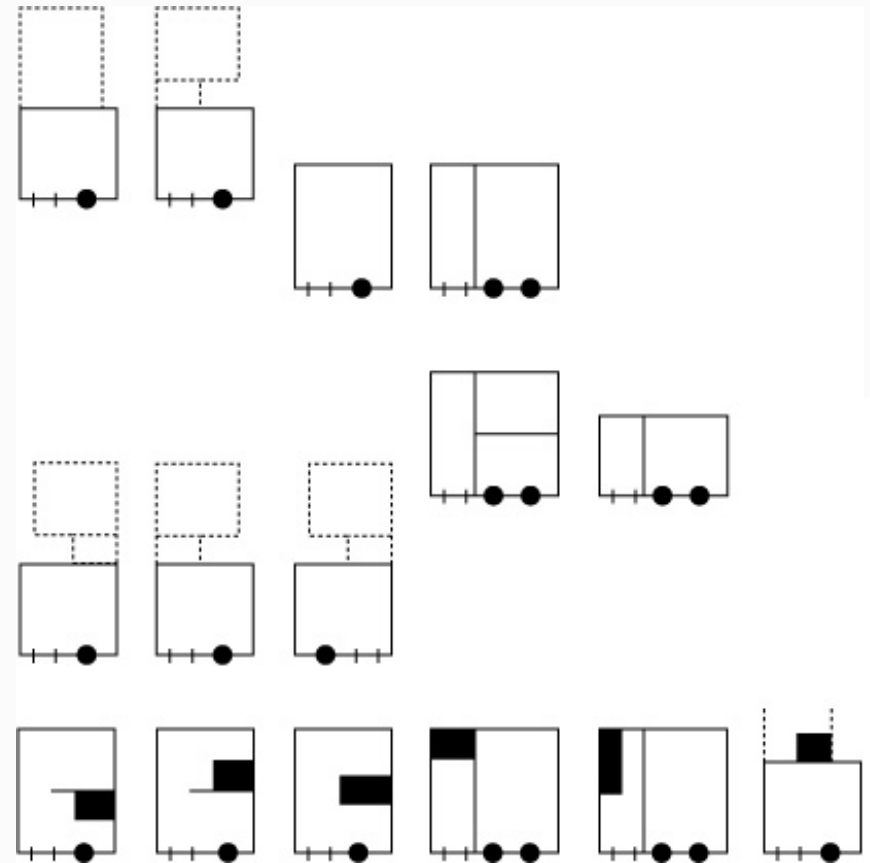
baltimore rowhouse grammar

baltimore rowhouse grammar

- consists of **52 rules** in **8 phases**

- conventions unique to this grammar
    - every rule is either required or optional
        - required rules must be applied, if possible
        - optional rules may be applied at the user's discretion
        - the set of optional rules applied by the user determines the design outcome
    - rules must be applied in sequential order
    - when applied, rules must be applied exhaustively
    - shapes are situated within a two-dimensional space (U2) with fixed front, back, left and right directions
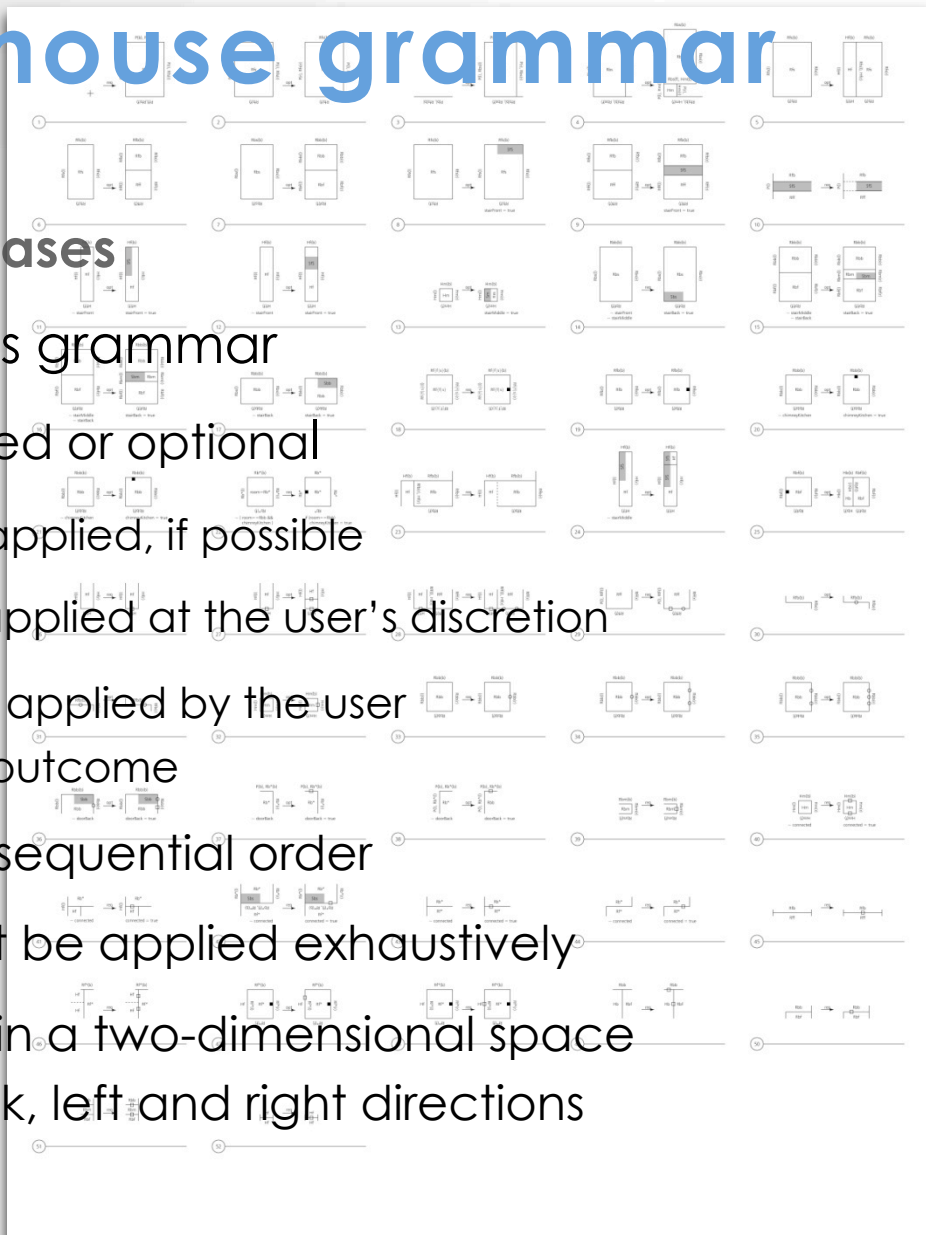
labels

- local labels

  - attach to a subshape (specifically a point, line or void) within the working design and shape rules

  - primarily used to establish identities and locations

  - format: Xyz(a)

    - X: space type (Room; Stair; Hallway)

    - y: primary location (front, back, middle)

    - z: secondary location (front, back, middle, single)

    - a: orientation of boundary wall (front, back, left, right)

  - ex. Rfb(b) = Room front back (back) = back room of dining room

labels

- global labels

  - do not attach to a subshape

  - primarily used to control rule applicability

  - each has a Boolean value, false by default

  - ex. stairFront [the front block contains a stair], doorBack [the back block contains an exterior door], connected [all blocks are linked]

phases

- grammar rules are frequently grouped into phases

  - phase: a set of related shape rules that may be applied at a given point in the grammar interpretation

- the rowhouse grammar consists of 8 "soft" phases:

  1. block generation (1-4)

  2. space generation (5-7)

  3. stair generation (8-17)

  4. fireplace generation (18-22)

  5. space modification (23-24)

  6. front exterior feature generation (25-29)

  7. middle and back exterior feature generation (30-39)

  8. interior feature generation (40-52)

- each individual rule must be applied at a specific point during interpretation, so these are not "hard" phases

block generation

1. generate the front block (req)

2. mirror the front block (opt)

3. generate the back block (opt)

   - houses without back blocks do exist, but they are rare.

   - this rule allows the back block to be mirrored, relative to the front block

4. generate the middle block (opt)
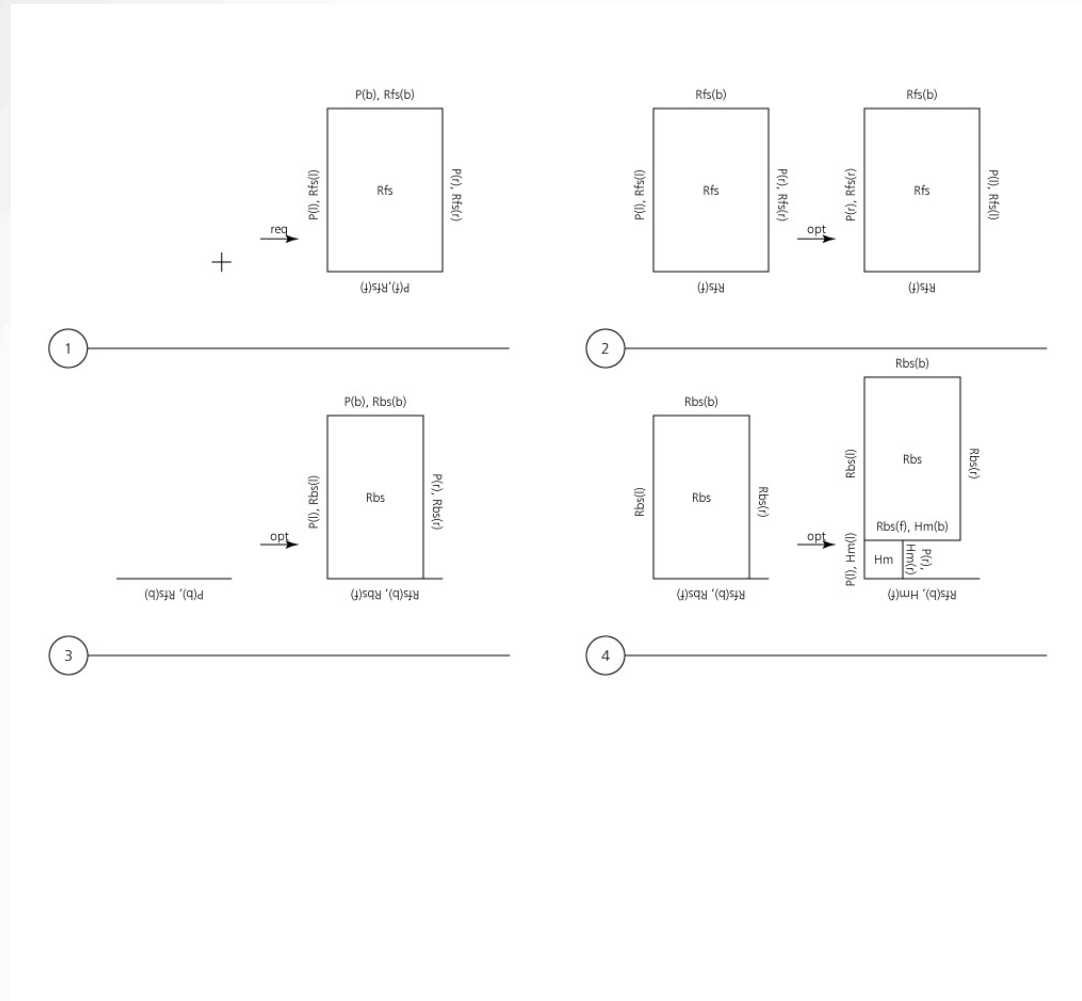
space generation

5. generate a hallway in the front block (opt)

- this rule determines whether the rowhouse is two or three bays wide
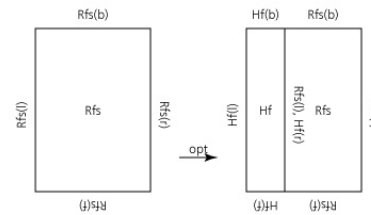
6. generate two spaces within the front block (opt)
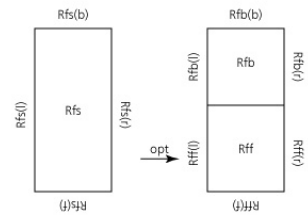
7. generate two spaces within the back block (opt)
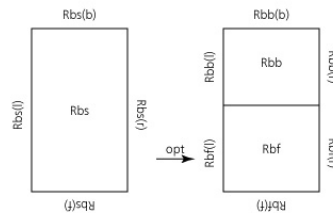
stair generation

8. generate a stair at the back wall of a single-space front block (opt)

9. generate a stair between the two spaces of a double-space front block (opt)

10. modify the stair generated by rule 9 if it runs the entire width of the house (req)

11. generate a partial width stair in the front hallway (opt)

12. generate a full-width stair in the front hallway (opt)
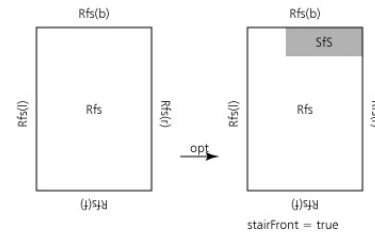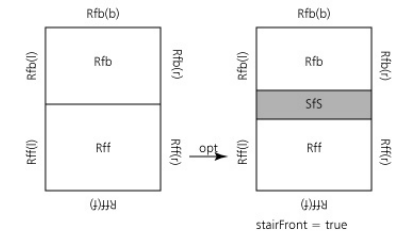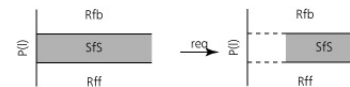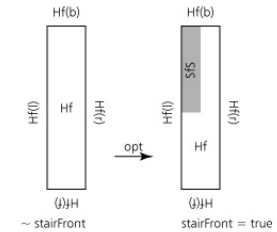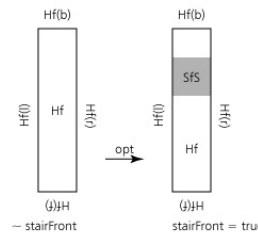
stair generation …

13. **generate a stair in the middle block (opt)**

14. generate a stair at the front of a single-space back block (req)

- This rule is required because it is the last possible rule that generates one of the required stairs. As such, it constitutes the default case. Note that the global rule prevents it from matching if a stair has already been generated.
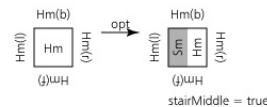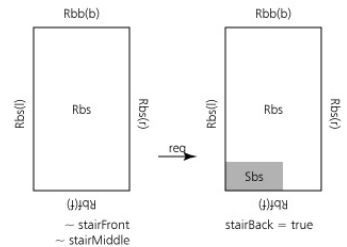
15. generate a partial-width stair between the two spaces of a double-space back block (opt)
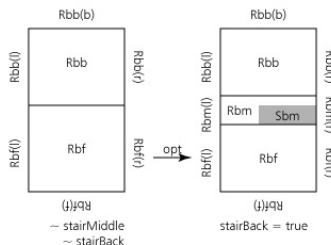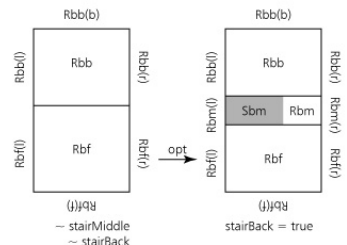
16. generate a full-width stair between the two spaces of a double-space back block (opt)
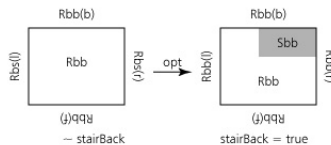
17. generate an accessory stair on the back wall of the back room of a back block (opt)

fireplace generation

18. generate the fireplace in the parlor (req)

19. generate a fireplace in the dining room (opt)

20. generate back-block fire places (opt)

21. generate back-block fire places (opt)
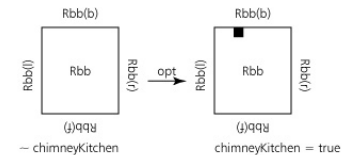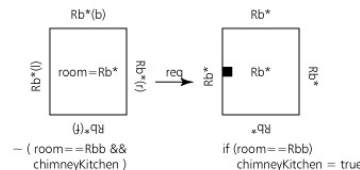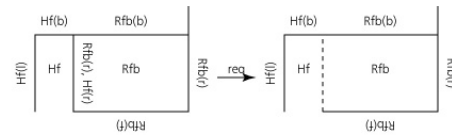
22. generate back-block fire places (req)
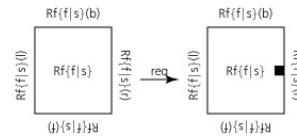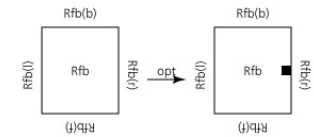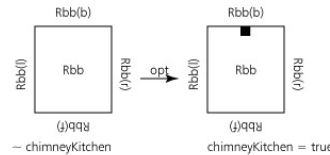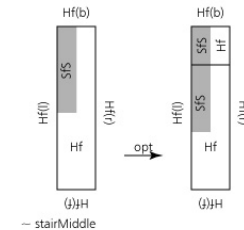
space modification

23. modify the back room of a front block if the front hallway does not adjoin the middle or back block (req)

    - This is necessary when a house has a hallway and its back block is mirrored relative to the front block. Otherwise, the blocks cannot connect

24. generate a service stair behind a partial-width stair in the front hallway (opt)

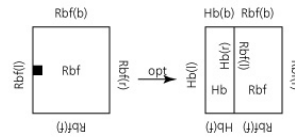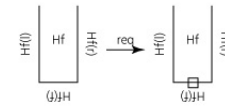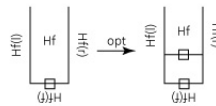# exterior feature generation
– front

25. generate a hallway in the front of the back block, removing the fireplace (opt)

26. generate the exterior door into the front hallway of a three-bay configuration (req)

27. generate an entry vestibule in the front hallway of a three-bay configuration (opt)

28. generate the front windows of a three-bay configuration (req)

29. generate the front door and window for a two-bay configuration (req)
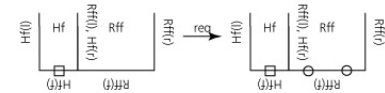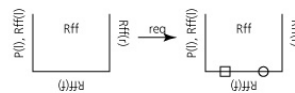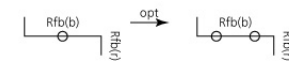
exterior feature generation
– middle and back

30. generate a window on the back wall of the front block (opt)
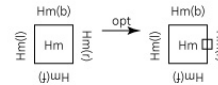
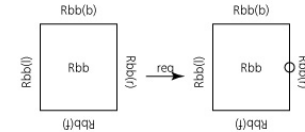31. generate an additional window on the back wall of the front block (opt)

32. generate an exterior door into the middle block (opt)

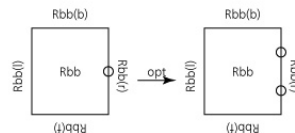33. generate a window in back-block spaces (req)

34. generate an additional window in back-block spaces (opt)

35. **generate an additional window in back-block spaces (opt)**

36. generate an exterior door on the side wall of the back-most space when a stair is present on the back wall (opt)

37. generate an exterior door on the 'right' side of a back wall (opt)

38. generate an exterior door on the 'left' side of a back wall (req)

   - This is required for the default case.

39. generate an exterior door in a back block with partial-width stair (req)
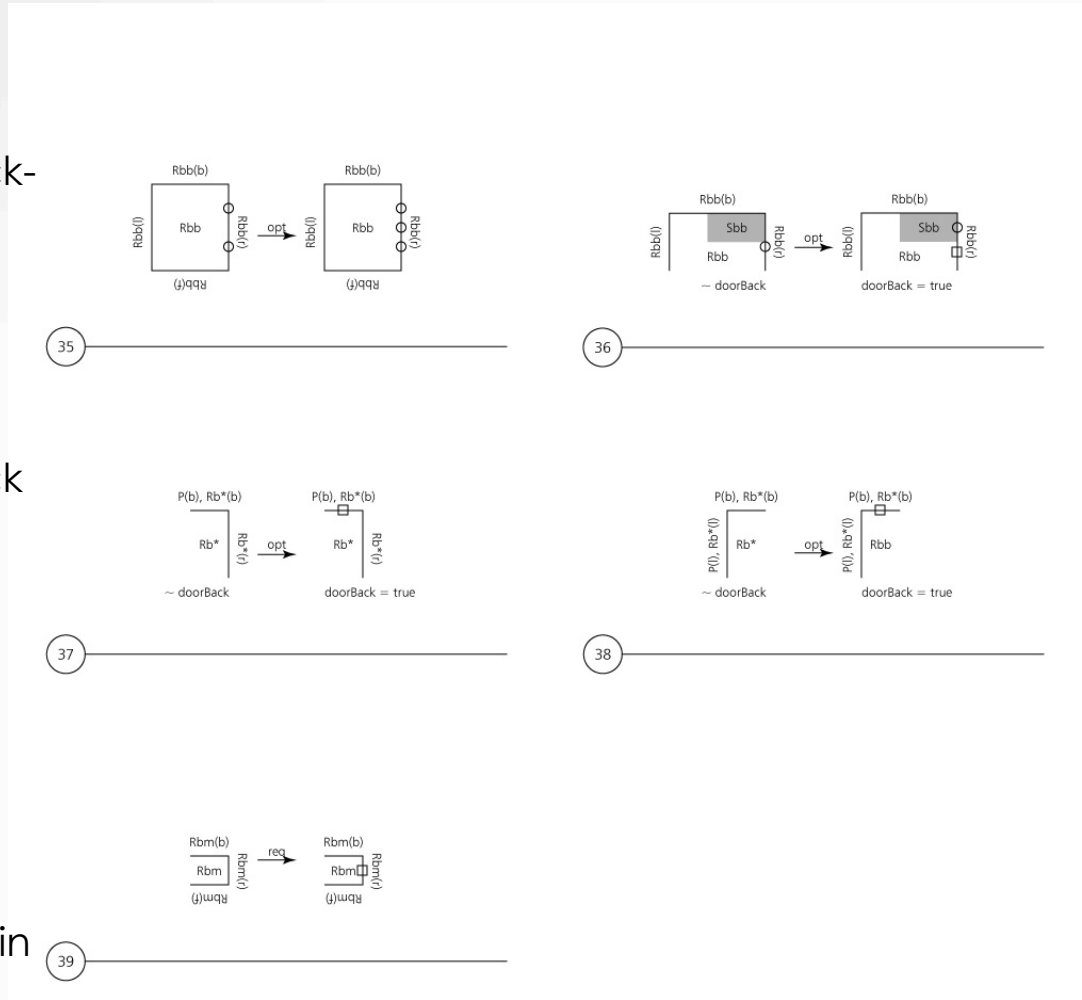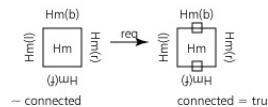
Interior feature generation

40. **generate interior doors connecting the front, middle and back blocks (req)**

41. generate an interior door connecting front hallway and back block when there is no middle block (req)

42. generate an interior door connecting front and back blocks when a stair is present on the front wall of the back block (req)

43. generate a left-side interior door connecting the front and back blocks when there is no middle block or front hallway (opt)
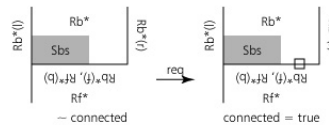
44. generate a right-side interior door connecting the front and back blocks when there is no middle block or front hallway (req)
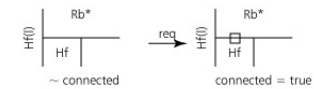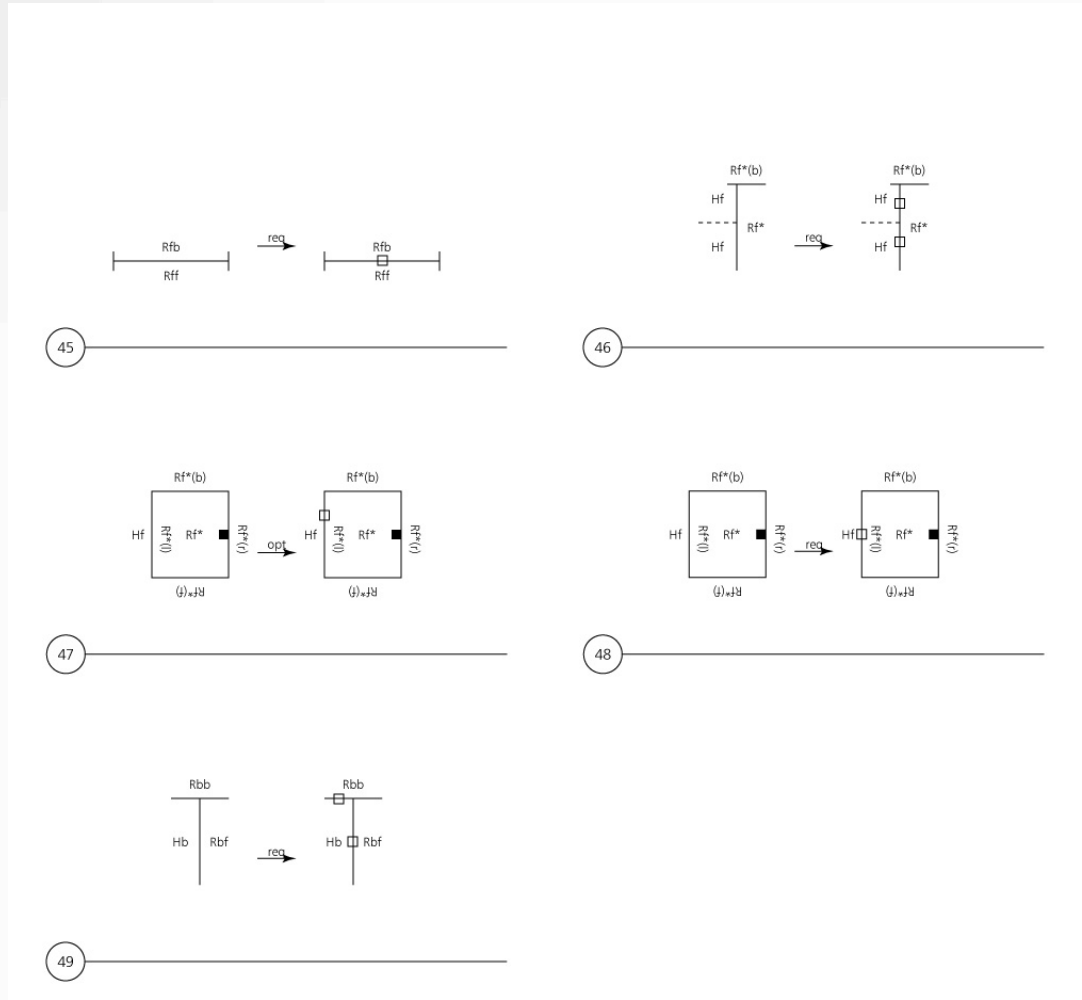
45. **generate an interior door between the front and** back spaces in the front block (req)

46. generate interior doors between a front space and front hallways when the front block contains two divided hallways (req)

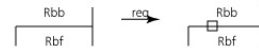47. generate asymmetric interior doors between the hallway and spaces in the front block (opt)

48. generate symmetric interior doors between the hallway and spaces in the front block (req)

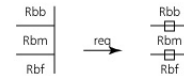49. generate interior doors when the back block has a hallway (req)

interior feature generation ...

50. generate an interior door between the front and back spaces in the back block (req)

51. generate interior doors between front, middle and back spaces in the back block (req)

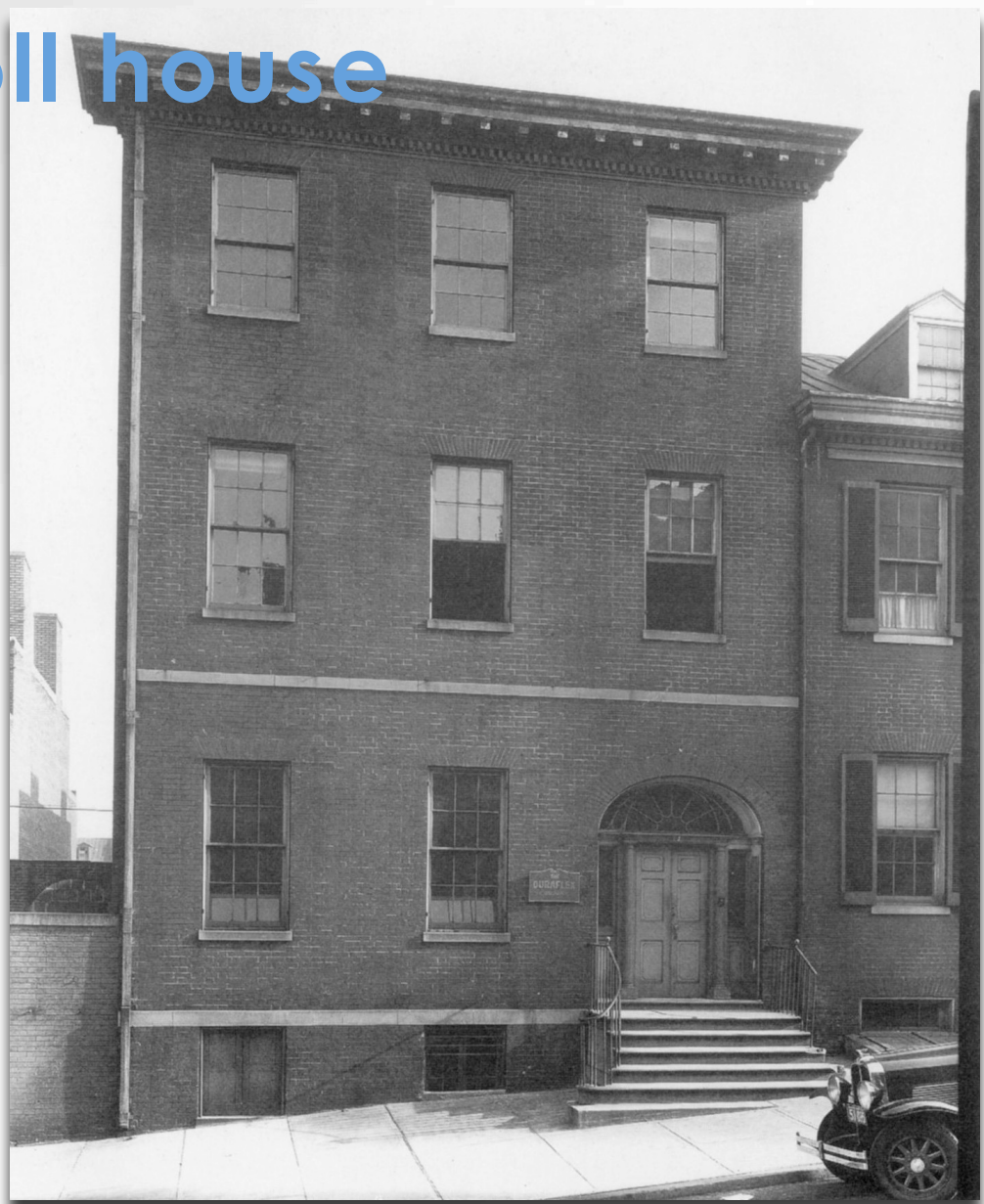52. generate an interior door between adjacent front hallways (req)

riddell-carroll house

11 East Pleasant Street

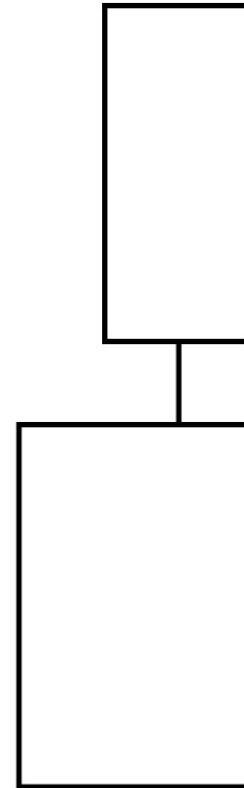- **built 1810-1811**

- **demolished 1935**

Alexander RL. 1993.
"The Riddell-Carroll House in
Baltimore." *Winterthur Portfolio
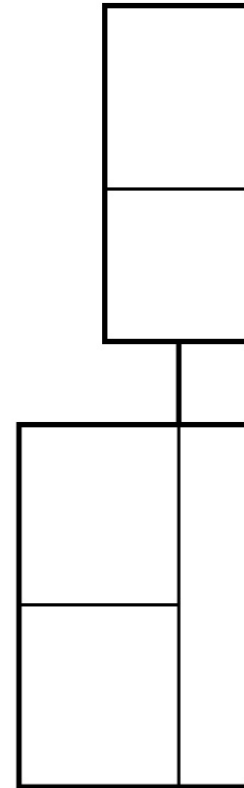28*(2/3) 113-139.

block generation

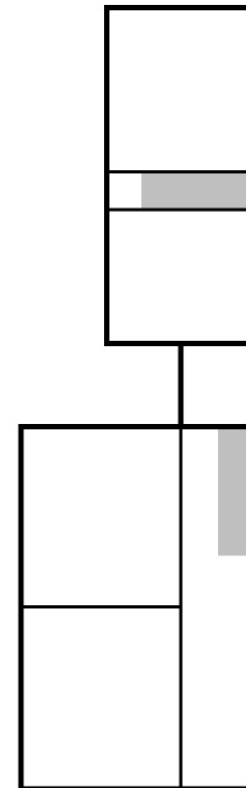- Rules Applied:

- **Phase I: 1, 2, 3, 4**

space generation

- Rules Applied:

- Phase I: 1, 2, 3, 4

- **Phase II: 5, 6, 7**
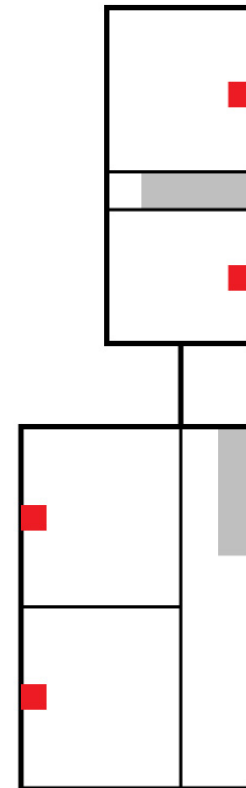
stair generation

- Rules Applied:

- Phase I: 1, 2, 3, 4

- Phase II: 5, 6, 7

- **Phase III: 11, 16**

fireplace generation

Rules Applied:

- Phase I: 1, 2, 3, 4

- Phase II: 5, 6, 7

- Phase III: 11, 16

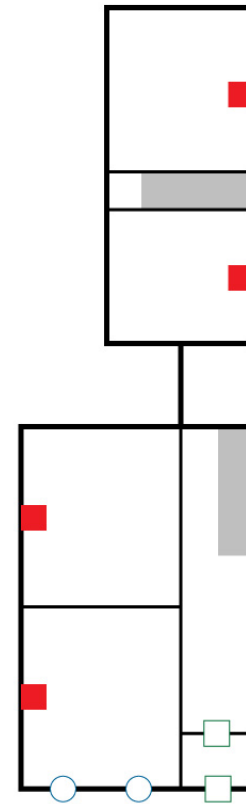- **Phase IV: 18, 19, 22**

exterior feature generation
– front

Rules Applied:

- Phase I: 1, 2, 3, 4

- Phase II: 5, 6, 7

- Phase III: 11, 16

- Phase IV: 18, 19, 22

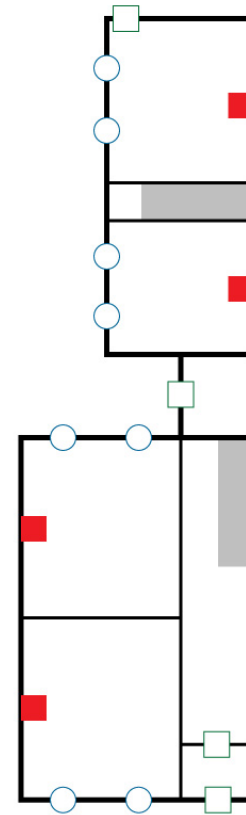- Phase V: none

- **Phase VI: 26, 27, 28**

exterior feature generation
– middle and back

Rules Applied:

- Phase I: 1, 2, 3, 4

- Phase II: 5, 6, 7

- Phase III: 11, 16

- Phase IV: 18, 19, 22

- Phase V: none

- Phase VI: 26, 27, 28

- **Phase VII: 30, 31, 32, 33, 34, 38**

interior feature generation
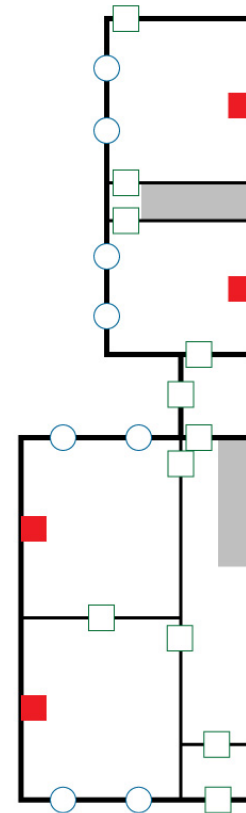
Rules Applied:

- Phase I: 1, 2, 3, 4

- Phase II: 5, 6, 7

- Phase III: 11, 16

- Phase IV: 18, 19, 22

- Phase V: none

- Phase VI: 26, 27, 28

- Phase VII: 30, 31, 32, 33, 34, 38

- **Phase VIII: 40, 45, 47, 51**

comparison
with actual configuration

Unaccounted Features:

- smokehouse at Rbb(b)

- window at Rbm(r)

- closet in Rbm at Rbf(b)

- window in Rbf at Rbf(f)

- pantry configuration in Rm with doors at Rbf(f) and Hm(l)

- additional window at Hm(r)

- cellar way with doors at Hm(l) and Hf(b)

- second door between Hf and Rfb
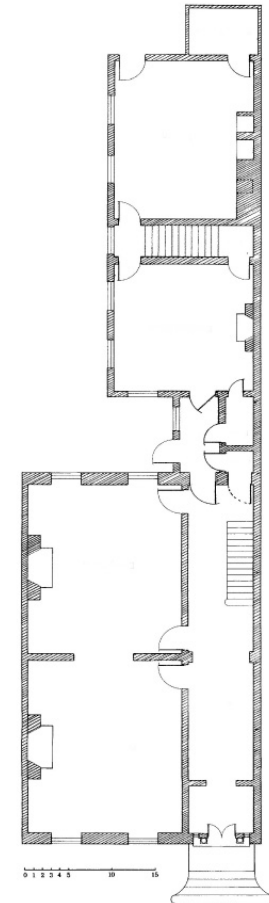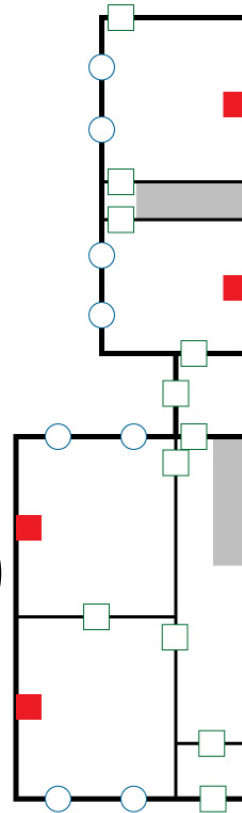
actual configuration

further work

- verify the grammar against additional examples of vernacular rowhouses

- incorporate additional interior features

- generate upper floor configurations from lower floor

- investigate the possibility of expanding the grammar to incorporate a wider variety of rowhouses

  - expand the grammar to encompass contemporary rowhouses

  - establish boundaries between different kinds of rowhouses for the purpose of defining additional grammars

- investigate the grammar's efficacy in the 'pruning' technique for layout prediction