

Notes on the Synthesis of (Typology and Technology in Housing) Form

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SIGNIFICANCE AND OBJECTIVES OF TYPOLOGICAL RESEARCH

A significant area of research in modern architecture has focused on typological issues, or the configuration and clustering of residential units.¹ In residential architecture typology is strongly linked to culture, urban form, and construction technology: the single family house in the USA is one of the best examples of this relationship. As a powerful icon of cultural values, it has been the focus of housing research, but today realities indicate the need to consider a wider variety of housing types for urban and suburban development. The most pressing issues of typological research are:

- the concern for sustainable growth and suburban sprawl that has prompted the study of higher density urban models, such as Peter Calthorpe's pedestrian pockets;
- the search for more urbanity and sense of place in suburban communities that has prompted planning authorities and private developers alike to adopt traditional neighborhood design principles;
- the socio-economic decline of the inner city fabric where a great deal of urban poverty is concentrated, requiring housing solutions for low income and "unconventional" households like single-parent families;
- the demographic change, particularly the increasing elderly population of all income levels, with diverse housing preferences and needs.

Typological research can benefit community groups if the product of the research is presented in a usable, understandable way for specific situations, such as inner city neighborhoods, as part of a technical assistance service in the framework of university-community partnerships. The research on which this paper is based has successfully applied these processes to housing developments and the results are being organized into information packages for community developers. The purpose is to illustrate the range of housing options, the technological options (with an emphasis on manufactured and modular systems), and their implication on residential types (with related planning criteria, i.e. the density, relationship to street, and vehicular access for each typology). Furthermore, each typology can be described as a hierarchy of parts with a cost attached, allowing a preliminary estimating system to be set in place.

HOUSING TYPOLOGY

Typology can be used both as an analytical tool and a conceptual frame of reference with which to generate form.² As the typological description of the building includes grouping or layout (terrace, court, etc.), it represents a connection to urban form. The

focus of this paper is the identification of house typologies that are suitable for the reconstruction of inner city neighborhoods and for the development of new housing in a more dense, urban form. It can be seen that these urban typologies can be easily adapted to industrialized construction systems, such as modular and HUD-code homes, that can contribute to lower the construction costs. In the USA, the powerful processes that affect typology and urban form (such as availability of rural land and the mortgage system) have created a construction industry geared to the suburban single family home. Therefore manufactured or modular homes typically have a wide frontage and front two-car garages, and there are few models suitable for inner city narrow lots or low-rise multifamily. An additional concern is the lack of compatibility of industrialized housing with local architectural character and with historic neighborhoods.

The increasing momentum of New Urbanism is contributing to the revision of the standard palette of builders pattern books, with smaller setbacks, rear-alley access garages, and a growing attention to local traditions. As the modernist, public housing typologies are abandoned, the search for appropriate typologies is not a simple functional problem-solving issue, but demands the investigation and questioning of the roots of contemporary housing design and urban development. This paper discusses the evolution of American residential design up to current experiments with manufactured and modular construction. It shows how some current research is in turn adapting these technologies to neo-traditional typologies, and how relatively few plan types can produce a large variety of housing configurations.

ANALYSIS OF TRADITIONAL AMERICAN HOUSE PLANS

American history has produced a great variety of housing types, from the rural one- and two- room cabins to multi-family rental housing that became common after the 1840s. Nevertheless, it is possible to find some common themes in types and design methods. The close connection between housing form and American culture gives to the American house what Upton calls an "iconic status".³ The archetypes can be recognized in the process of the evolution of colonial types during the 17th century.⁴ This process was one of simplification from a great variety of houses of various European origin to a fewer more standardized types. One of the most representative is the Virginia rural house, also diffused in New England, a type of two-room house displaying a long axis (connecting the fireplaces) and a transverse axis marked by the entrance on the long side (Fig. 1).

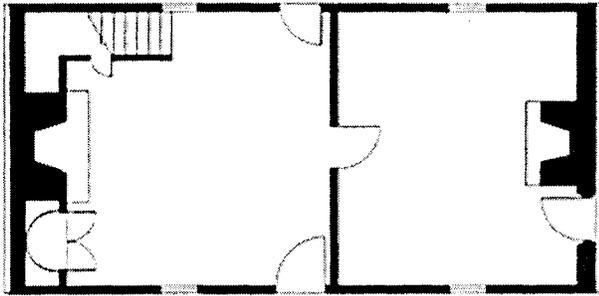


Fig. 1. Hall-parlor colonial house in Virginia: Henry and Anne Saunders House, c. 1795.

There are two important developments of this primitive hall-parlor plan. One is the enclosure of the entrance hall (often expressed on the facades by entrance elements like porches) that leads to a cruciform plan; the other is the lean-to back extension that codifies the double-box plan. This medieval type was still surviving in the late 19th century, as its migration to the rural Midwest demonstrates. In 1869 Catherine Beecher rationalized this prototypical plan in the American Woman's House and imbued it with the morality of the Victorian era. In Beecher's version, the plan geometry is maintained, but the transverse hall now contains, in addition to the staircase, the kitchen within a prototypical "mechanical core."

A second fundamental typology of the American house originates from the rows or terraces, on the English or Dutch model, like the eighteenth century apartment plans in Philadelphia. The so-called "London plan" duplexes basically turned the hall-parlor plan 90 degrees, keeping the transversal staircase, but placing the entrance on the short side facing the street. The later picturesque Victorian villa or cottage promoted a compact, unsymmetrical plan that has survived as one of the strongest domestic images in our contemporary housing. As in the Prairie houses, Wright introduced an extremely clear form of geometric control⁵ in this double-box narrow frontage typology. Wright's method of the shifted rectangles used in the Robie residence generated the "American System Ready-Cut Duplex Flats" of 1915 and in the "American System Ready-Cut Bungalow" that, in typical Wright's fashion, has a side porch and off-axis entrance. The flats are composed with two shifted rectangles that identify a circulation space in their area of overlap. The setback at the two ends creates a space for a porch and balcony and for vertical circulation (Fig. 2).

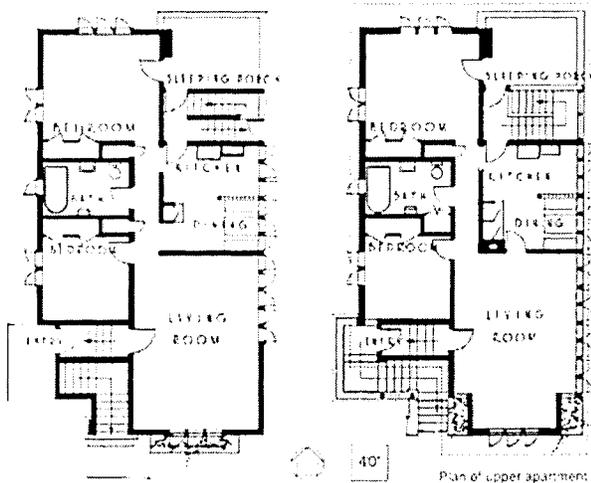


Fig. 2. "American System Ready-Cut Duplex Flats" by Frank Lloyd Wright, 1915.

TRADITIONAL HOUSE TYPOLOGY AND MANUFACTURING TECHNOLOGY

Wright's shifted-rectangles plan form can be recognized in what could be called the "traditional" urban houses taken by Peter Calthorpe⁶ as models for relatively high density development and ancillary units at the back (Fig. 3). An important characteristic of this type is its compatibility with modular construction, intrinsic to all the typologies discussed earlier.

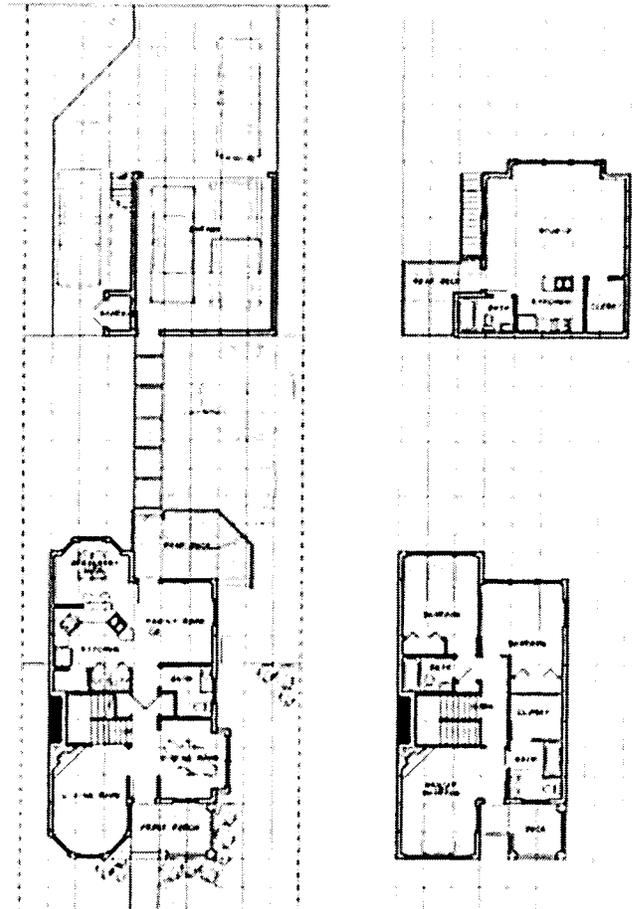


Fig. 3. Urban house type with ancillary unit at the back derived from Peter Calthorpe's *The Next American Metropolis*. Note how the plan geometry could allow modular prefabrication

Manufactured housing, technically known as HUD code homes, is the cheapest of the products available in the market, and it has evolved from the trailer or mobile homes into a semi-permanent type of house. Its potential for affordability is offset by the zoning exclusion from normal residential areas and by the poor design quality that has contributed to its stigma. This technology affects typology in a number of ways:

- the integrity of the "boxes" has to be maintained, and there are structural limitations to the amount of wall area that can be eliminated to create connections between modules; this also affects the extent of openings on the outside wall;
- the transportation limits the width, length, and height of the module (typical widths range between 12 and 16 ft.);
- the roof structure is integral with the module, and the roof shape is affected by the height limitation;

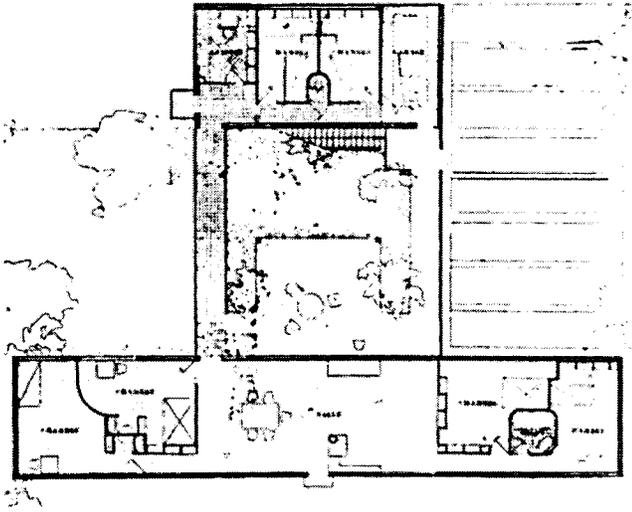


Fig. 4. Le Corbusier, project for a villa in Bordeaux, 1921.

- the chassis with wheels used for transportation, part of the HUD code requirements, is a serious obstacle for the construction of two-story houses, and in fact the common production is limited to one-story homes.

While the main design problem of the manufactured house is its trailer shape, several solutions have been proposed to turn this liability into an advantage. The modernist aesthetics were never fully exploited, probably due to the vulnerability of flat roofs, although Le Corbusier's Bordeaux villa project of 1921 has a strong affinity with the mobile home typology. Without the ancillary unit occupying the backyard, this arrangement would be inefficient from the point of view of land use in a traditional neighborhood (Fig. 4). It is interesting how this industrial product resisted all types of "styling" attempts by architects such as Paul Rudolph and the Frank Lloyd Wright Foundation⁷ and it has gradually evolved into a "normal" or traditional house form.

It is common in manufactured housing production to offer "double-wide" models, that are planned according to the basic concept of two rectangles side by side. As part of a research project on affordable housing by the Housing Futures Institute (HFI) at Ball State University, a number of two-story house types was designed for use in urban or suburban lots using HUD code technology.⁸ The technological problem of the chassis has been solved by making it integral with the floor framing, allowing standard production of a two-story model. The typological concept is based on two rectangular modules spaced eight feet apart and forming a longitudinal hallway. Out of four basic types, one was selected for construction and built in a normal subdivision in Elkhart, Indiana (Fig. 5).

Following research based on manufactured housing parks in Florida, A. Douany and E. Plater-Zyberk have designed a community with a normal, stable appearance but using single story HUD code units.⁹ Other experiments with the Manufactured Housing Institute have continued the search for a two-story construction compatible with historic neighborhoods such as the Urban Design Project (with New Era Building Systems in Pennsylvania), and the NextGen house in Oregon (Fig. 6).

The 1991 *Progressive Architecture* affordable housing competition¹⁰ recognized the potential of modular housing systems in reducing construction costs and the unfortunate fact that few modular housing companies have developed urban house models suitable for narrow city lots. The competition produced solutions for modular infill houses for Cleveland using widths as narrow as 12 feet. HFI's current research is looking into the use of modular construction for a broad range of housing types in central city areas.

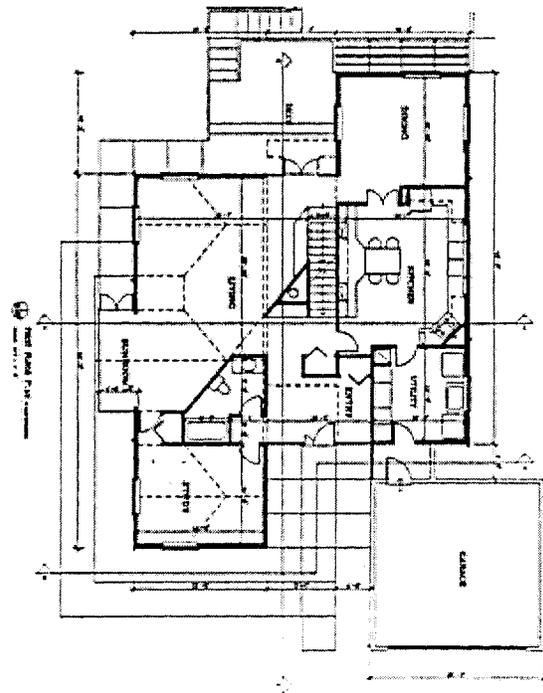


Fig. 5. HFI's New Manufactured House, Elkhart, Indiana, 1995: plan and model.

The technical limitations of this system are less stringent than for manufactured housing, but while narrow frontage models are becoming available, it is still difficult to find multifamily modular producers outside the east coast.

In the research mentioned here, the system has been tested to decrease construction costs in a downtown housing complex for the elderly.¹¹ In multifamily construction, the common access and circulation scheme can affect cost significantly, as this has to be built in situ as a separate structure. The modular concept helped in the public participation process: a model made with wood blocks, each representing a module approximately 12 ft. x 24 ft. in plan, made it easier for people to grasp the scale and the grouping of the residential units. The model was used in interactive sessions to discuss housing forms and densities with the public. This shows how technology and typology can become useful tools for communication between the architect and the other parties involved in the design process. A catalog of modules and units options also helped with the preliminary costing.

ADAPTABILITY AND FLEXIBILITY FOR CHANGING MARKETS AND REQUIREMENTS

According to M. Pyatok, ideas for workable change can only be evolved through extensive involvement of the inhabitants themselves from the outset of the design process.¹² The act of dwelling is an integral part of the daily existence; building communities is a dynamic process. As mentioned earlier, designing for adaptability and future change has been an important aspect of typological research in the last 30 years. The Next Home developed at McGill University¹³ is an example of a recent study on this question, which includes the individualization and personal expression that are part of the sense of belonging to a place.

In the HFI's studies for inner city housing the theme of adaptability has been explored with standard modular dimensions that can be adapted to different plan configurations and building types (Fig. 7).

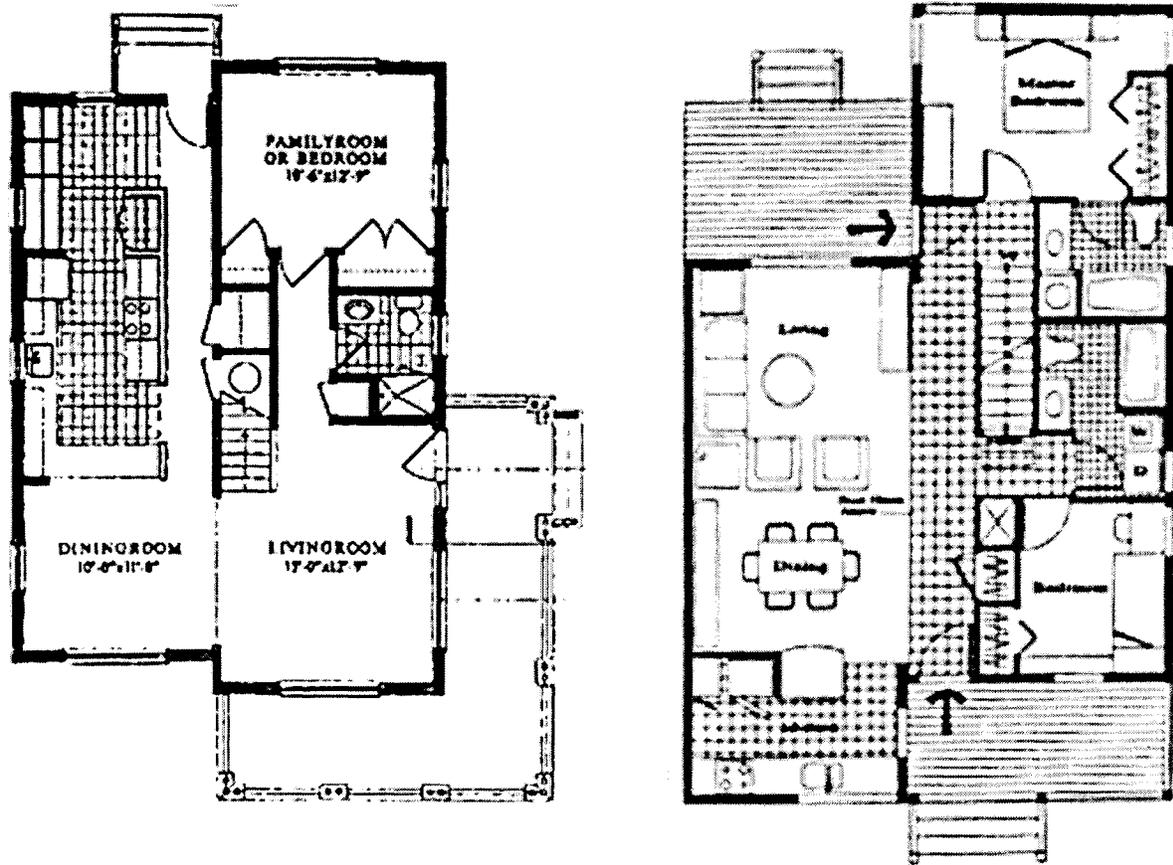


Fig. 6. Prototypes for two-story manufactured homes for inner city neighborhoods: the New Era Building Systems plan (left), and The NextGen plan (right). Compare the plan of the New Era house and the NextGen plan with the New Manufactured House and Wright's Duplex Flats.

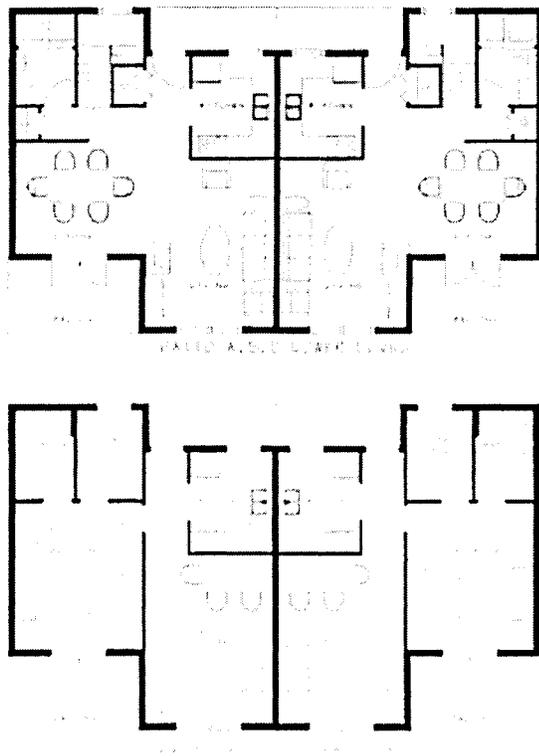


Fig. 7. The same modular shell can be manufactured for three-bedroom townhouses or one-bedroom apartment (Housing Futures Institute).

Some typologies used for row houses can also be used for duplexes, single family houses, townhouses, or apartments with a small number of modifications. The classification of these typological variations is based on interior layout (day and night zones), wet areas location, access and interior circulation, frontage width, number of rooms, and number of modules. This adaptability can be conceived for:

1. Flexibility of production with different plan layouts using the same shell;
2. Customization of the interior layout for specific design solutions;
3. Adaptability for future change within the unit;
4. Expansion, additions, and optional elements.

CONCLUSIONS

Research on housing design can, like in housing competitions, produce innovative design solutions and processes. Typological studies can find solutions that make traditional plans and housing forms compatible with efficient construction technologies. They can also provide an architectural metalanguage usable in conceptual design, in the formation of design guidelines, and in public participation processes. This meta-language of housing forms is more understandable when it is generated within a tradition that is common to architects and to communities. Typology is part, in fact, of a culture as well as of a thinking process and as such it is an analytical tool that can be usable in design research and education.

Typological classifications must also indicate the relationship with urban form and density, and the hierarchy of spaces connecting the private with the public realm. Simple diagrams, being evolved as the research progresses, can be used as a communication and

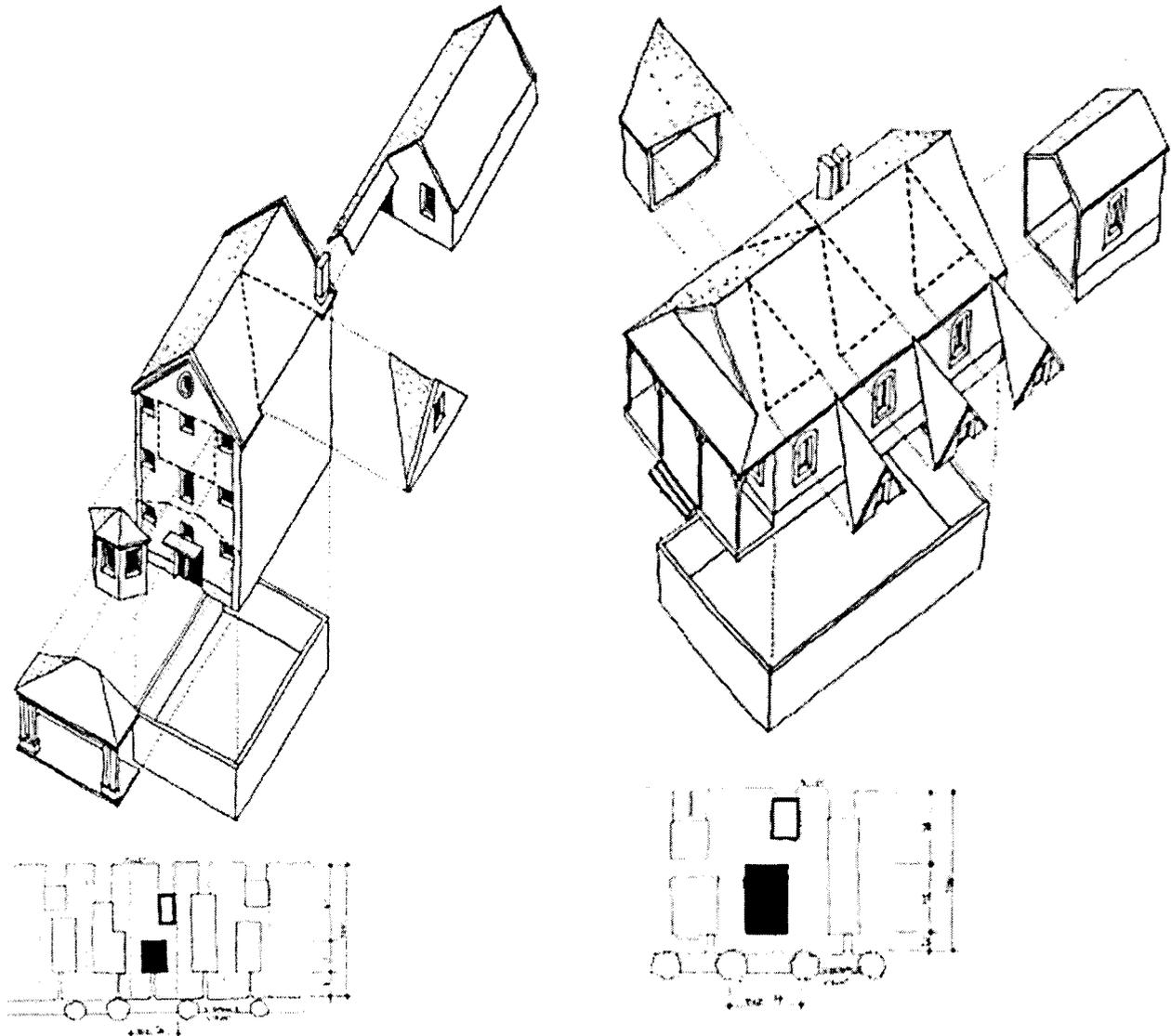


Fig. 8. Axonometrics of modular houses for infill sites showing options that can be added to the basic shell (from the Housing Futures Institute *Infill Housing Manual*).

conceptual design tool to explore possible options. Among the products of this research are housing manuals for community housing organizations (Fig. 8) and pattern books for housing producers, part of a university outreach effort that intends to bridge between the diverse realities of housing development by using a common language of housing typologies.

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