HOUSES FOR DORCHESTER
by
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ABSTRACT

The intent of this thesis is to develop a design for thirty units of housing responding to the development objectives of the Nuestra Comunidad Development Corporation (NCDC) in the Upham Corner district of Dorchester. It is about controlling variety and encouraging interaction within a context in which requirements for low cost dwellings prevail. It declares that through an explicit separation of parts, and calculated provision of excess capacity, a living environment will unfold in which form and process are united in a way that makes variety and choice more efficient, structures participation and encourages decentralized independent action through time. The form of this environment is first presented through drawings and text. A discussion of the meaning of variety, control and levels in form and process leads to a reinterpretation of the design. With this new understanding, two models of form and process based on varying patterns of control will be used to explore the development and evolution of the site during its life-stages of design, building, use and transformation.

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TABLE OF CONTENTS

Abstract ............ 2
Acknowledgements ............ 3
Table of Contents ............ 4
Preface ............ 8

PART I: THE DESIGN

The Setting
-Nuestra Communidad Development Corporation ............ 11
-The Site as Context ............ 16

A Response
-Introduction ............ 19
-Appearance of the Site ............ 23
  -Site Plan ............ 24
  -Building Plan ............ 28
  -Building Axonometric ............ 29
-Four Households ............ 30
Part II: THE SITE EXAMINED

Goals and means: A Clarification of Terms

- Variety
  - Manipulation
  - Personalization
  - Adaptation
- Control
- Efficiency
- Parts and Levels
- Capacity

Parts and Levels

- Who
- When
- What
Part III: FORM AND PROCESS EXPLORED

Introduction ........................................57

Traditional One Party control .........................58
- Participation and Design ........................................58
  - Sites, Buildings Units
  - Rooms and Uses
  - Building Elements
- Building .....................................................61
  - Manufactured & Prefabricated Components

- Use and Transformation ..................................63
  - Personalization
  - Adaptation

A Support and Infill Proposal .........................66
- Introduction ..............................................66
- A Support Design ..........................................69
- An Infill Design ............................................73

Implications of Support and Infill Decisions ....75
- Defining the Support ......................................75
  - Support Types: A First Step .........................76
  - The Minimum Support ....................................77
  - Variation within The support Type ..................78
Support and Infill Systems

- Process, Plan and Detail ............ 81
- System Interfaces ................. 82
- Partitions ...................... 83
- Stair Systems ..................... 84
- Enclosure Systems ................. 85
- Enclosure Detail ................... 86
- Equipment and Mechanicals ........ 88
- Floors, Decks and Paving .......... 89
- Summary ......................... 90

Conclusions ..................... 91

Bibliography ..................... 93
PREFACE

This thesis grows out of years of experience with houses and people, as a builder, as a staff member of a community development corporation, and as a student of architecture. Prior to studying design, I had the opportunity to see first hand the simplification, standardization and reduction in quality that accompanies rising costs and dwindling resources. Tough decisions were constantly made over where to expend the limited resources available.

Unfortunately design professionals were most often disinterested and ill equipped to contribute to the process. When the profession did turn its attention to the problem, the response was often in two extreme directions: a withdrawal to the role of advocate (the championship of total user control through self-help), or the development of new technologies as a universal panacea to what remained essentially complex organizational and decision-making problems.

As one of a number of exceptions to this rule, the work of SAR in the Netherlands proved particularly interesting in that it neither upheld technical solutions, nor abandoned the professional skills of the designer. The theoretical framework set forth by SAR See Bibliography
has as its central premise the idea that design and production of dwellings can be split into two levels, that of the community (support) and that of the household (infill). While the differentiation of the support from the infill is primarily a social, not a technical distinction, it does have technical implications about design, decision making, construction and management processes. The idea suggests that different spheres of power, community and household, should be associated with different parts of the building. The support would lie within the realm of the communities' collective decision making process, while the infill would be the responsibility of the household. The support would tend to be fixed load bearing elements and the infill lighter, variable and changeable elements. But the precise determination of support/infill elements would differ in each context being determined through negotiation or convention.

While this theory is rooted in a specific European housing context vastly different from what we find here in the United States, its essential significance lies in its potential for managing variety of form and complex patterns of control while increasing overall efficiencies of production. Indeed SAR has stimulated a diverse body of theory and practice that recognizes the
problem as primarily organizational in nature (how to efficiently make decisions about who does what, when), established a framework for working, and elaborated on existing design tools and methods. These ideas seemed to offer me a way to bring my evolving skills as a designer to the problems I had left behind.

It is thus my intent in this thesis to apply an assimilation of my design skills, the fundamental ideas behind the work of SAR and my experience designing and building under conditions of rigorous constraints to a design for housing.
PART I: THE DESIGN

THE SETTING

The setting for the design consists of a client group, Nuestra Communidad Development Corporation (NCDC), a program that grows from NCDC's ongoing effort to build affordable housing, and a site proposed for development by the Public Facilities Department of the City of Boston.

NUESTRA COMUNIDAD DEVELOPMENT CORPORATION

Nuestra Comunidad Development Corporation was formed in 1981 as a result of the efforts of La Alianza Hispana, The Hispanic Office of Planning and Evaluation (HOPE), and community leaders, to do housing and economic development in the Dudley street/Upham's Corner area. Nuestra has four Principal objectives:

- The Development of the community's awareness and involvement in the development process.
- The development and rehabilitation of low and moderate income owner occupied housing.
o The optimal use of vacant land to restore the health and viability of the neighborhood.

o The development of industrial and commercial enterprises that create jobs and revenues for the community.

The members of Nuestra see themselves as responding to a crisis of profound proportions. Fifty percent of the land in their neighborhood, over 150 acres, lies vacant. Of that, nearly fifty percent is owned by the City of Boston and the rest is held in private hands. Affordable housing is in short supply. Unemployment is very high. The rapid urban growth that has swept through other areas of Boston is expected to move into the Roxbury area in the future, raising land prices and housing costs, and ultimately displacing the present residents. Nuestra thus has as its primary goal the acquisition of land and development of affordable housing before land speculation puts it out of reach. In response to this situation Nuestra has expressed a commitment to build 120 units of housing over the next five years.
By early 1985, Nuestra had designed a three-bedroom, two-story townhouse and commenced construction of ten units on scattered sites in the Upham Corner district of Dorchester. Precut components supplied by a housing manufacturer allowed for lower skilled labor, and were capable of quick assembly, minimizing theft losses. A modular panelized system was thought to be easily modified, encouraging individual customization during design and adaptation over time; though in reality little participation developed and units were standardized to minimize costs and staff time. Future owners were selected by lottery, with annual incomes between $20,000 and $30,000. Financing consisted of a $15,000 per unit grant from the City of Boston, interim construction loans, and MFHA low interest loans to the owners. Nuestra intended to control speculation by establishing a household association that would own the land, leasing individual lots to the homeowners.

With just two units completed, Nuestra was dissatisfied with the limitations of the scattered site townhouse approach. The process was too slow to make a significant impact on the housing shortage. Efficiency of production had eluded them. Scattered sites were difficult to manage. The number of units was too large for the contractor they had, and too small to attract...
larger more efficient operations. In response, the staff searched for tracts of land that would permit larger developments of 30-40 units.

At around the same time the Public Facilities Department of the City of Boston stated a commitment to distributing vacant city land to help meet the goals of community development corporations like Nuestra. The department met informally with community leaders and on July 10, 1986 presented tentative guidelines for discussion of the development of the Dacia Block and other sites in the Nuestra neighborhood. Public hearings were pending, and a formal request for proposals was expected in late 1987.
DACIA BLOCK DEVELOPMENT PROPOSAL

Nuestra's preliminary proposal for the development of the Dacia Block Site called for construction of 30 units of new housing. The majority of housing units were to be 1,500 square foot, three bedroom, single family rowhouses, a modified version of the townhouses they had been building. The units were to include basements, one or two baths, laundry and utility room. Occasional one or two bedroom apartments, and larger four bedroom units were to be scattered throughout the site. Seventy percent of the units were to be for low and moderate-income households. Site development was to include street entrances, private yards, off street parking, a reconstructed public playground, and a community garden, as shown on the program sketch. The defensibility of the open space was considered of prime significance.
THE SITE AND CONTEXT

The site, designated the Dacia Block by the Boston Public Facilities Department lies between Blue Hill and Howard Avenues in the Upham District of North Dorchester. Originally densely settled by the lower middle class in the 1880's, the housing stock has greatly deteriorated and has been decimated by arson. Approximately fifty percent of the land is now vacant. Whole blocks contain only a handful of houses with large open areas in between. The houses that do remain include short blocks of brick row houses, triple deckers, and ornate single and two family homes.
DACIA BLOCK
A RESPONSE

INTRODUCTION

"Design is the playful creation and strict evaluation of the possible forms of something including how it is made." Lynch 1981 p. 290

We are accustomed to associating a design with a completed form represented in drawings and models. But as that quote by Kevin Lynch suggests it should be possible to express a design that deals with form, process and institutions together in one whole. This design may be written as well as drawn and involves speculation about not just the possible form, but how it got there, how it is managed and how it is changing. For this reason, the written portions of the thesis are as much a part of this imaginary world as the form itself.

For instance, we might imagine that, faced with the challenge of building many new houses and planning the development of whole city blocks, even neighborhoods, Nuestra might seriously reevaluate their previous design and building strategy. When houses designed for infill on scattered lots were combined in larger numbers it might become clear that an effort
would be required to more fully develop the public realm of the site, and add a richness and level of variety that one expects on a neighborhood scale. Their old approach of consciously building plain and simple houses, focusing scarce resources on pleasant interiors, leaving quality exterior finishes and site improvements to individual homeowners was inadequate. At the same time, as more houses were developed at once, owners could not be matched with houses as early on in the planning and design stages, and efforts at participation and owner involvement became more complex. Nuestra might come to feel that more independence was needed between what was happening on the site and what might happen within the units. In short, their commitment to both the community and the individual, once unevenly weighted towards the individual, shifted, becoming more complex and rich with conflict.

This commitment to the community might be seen to include not just the quality and richness of environment that one sees in healthy old neighborhoods (and expects from good developments), but also a rich capacity for the future, for change, for continuing viability in this rapidly changing context. There is nothing new in this; these are well accepted standards of "Good" environments and quality design. Indeed,
conventional American building technologies have qualities that enable rich interpretations, opportunities for inhabitation and adaptability for changing needs. But this variety has become ever more costly. The complexity of different parties choosing different things might prove too inefficient and expensive. Rising costs conflict directly with the primary requirement of the individual: to keep costs down, keep things simple. Thus with resources strained, we can imagine that Nuestra, feeling pressure to simplify processes and standardize products, would want to be able to tell their contractor that every house was the same, that he was building ten identical buildings.

New technologies, or cutting labor costs through self-help did not seem to address the core issues. The problem was more general; it was one of making lively, living places under tight budgets: how to design, how to bring form and process together so that variety and capacity for change and personalization were made efficient, not just in the process (participation), but in the form, so that the form itself encouraged interaction and involvement and opportunities for personalization, so that the form became the process, a living thing that people can act with and make their own.
The response that follows grows from efforts to achieve such an environment. It is based on the premise that variety and choice can be managed efficiently, enabling participants to set priorities and resolve tradeoffs between conflicting demands. Such a response organizes systems into distinct levels clearly delineating which things vary and which remain fixed. Such a response clarifies the boundaries of who does what; that is, which decisions are made by which participants (Nuestra Staff, the household, the land owner...) at various stages in the project's life. And finally, by enabling independent yet coordinated action in design, construction and use, such a response supports a variety of patterns of control and form.
THE APPEARANCE OF THE SITE

As one moves through the Dacia block neighborhood, clumps of isolated buildings among large empty and overgrown lots give way to a dense and cared for cluster of tree lined streets, new houses and an occasional shop. The old pattern of ornate single and two family homes on large lots, triple deckers and short blocks of row houses is gone, but the new pattern maintains a similar sense of rhythm and depth and commitment to the street. Individual rowhouses directly face the street, their stoops and front yards reflecting the individual character of the residents. Small parking areas, in close proximity to the houses they serve break the street edge. Larger two family homes set back from the parking area offer a different sense of place and suggest the depth of the block. From the road one can peer through to see the sheds and fences and life at the backs of these houses.

Farther down the street a parking area turns into the block, with more houses fronting a small alley beyond. Private paths lead from the alley, moving through the interior of the block, linking back yards with each other and the alley in front. Fences or walls
clearly define the boundaries of private yards. While the street edge was quite orderly, in the rear many different things can be seen happening. There are decks with patio doors to living rooms, second floor decks with stairs to the ground, an assortment of sheds and occasionally an entire extension of the house. Some yards are empty, in some there are gardens, and in some collections of junk.

Across the alley, on the other side of a line of trees, the block opens up into an area of common land that extends to the opposite street. Near the alley, easily accessible to the private paths is a small childrens' play area and nearby a shaded seating court for adults to chat and keep an eye on their children. Across the lawn the hill breaks into a rock outcropping, a favorite play area for older children. The dense cover of trees has been thinned and paths link the area to the lawn below, enhancing supervision and surveillance. Farther towards the street, beyond some trees and over a rise, we find a larger playground, an expanse of lawn and a fenced off area sporting a few small vegetable gardens. A parking area off the street offers neighborhood access and a place to change a tire or tune up the car.
At one corner, a larger building houses a small variety store, and through what appears to be an active daycare center one can see into a rear courtyard and play area. Clothes hanging to dry on a second floor porch and a table and chairs on the third hint at the life in the apartments above. The brick party walls of the adjacent rowhouses provide an organizing framework within which their individual facades are more richly articulated. Siding materials and colors vary. Some have second floor porches; others have living rooms or kitchens that project. One shows a separate entrance for a ground floor tenant.

Within the houses the type, number and orientation of rooms and uses vary. In some the slope of the land allows ground access to the basement. Some households have expanded to occupy the attic space, adding skylights and a roof terrace. Some plans are open and informal, others are closed and formal. In some the living areas are in the rear, in others we find these activities at the front. In each case these differences reflect responses to conditions of the site, of the orientation of the unit, and individual notions about how and where daily activities should take place. And this in turn contributes to the changing character of the street.
FOUR HOUSEHOLDS
HOUSEHOLD A

- Owner occupied
  - single unit
- Three bedroom
- Mbr front with porch
- Living room front
- Enlarged bath

We can imagine that to save money this family has left the attic for future expansion, but they have added a deck off the kitchen, a shed in the rear, and expanded paving and plantings at the entrance.
HOUSEHOLD B

- Owner occupied
- Four bedroom
- Living rear
- Separate dining room
- Ground floor bath
- Attic retreat
- Roof deck

With three children this family felt they needed all the space they could get. The living area is in the rear to take advantage of the yard and access to play areas. A downstairs bath was felt to be important for the kids, and finally, the attic and roof top retreat more than make up for the small size of the master bedroom.
HOUSEHOLD C

- Owner occupied with in-law apartment
- One bedroom and two bedroom
- Ground apartment claims front yard territory
- Upper apartment has bedroom porch and rear deck with stairs to the yard

The owner, a single mother has chosen to rent the first floor to her parents. They both enjoy separate entrances, yet share the backyard. The attic serves as a private suite for her pre-teen daughter.
HOUSEHOLD D

- Owner occupied
- Single unit.
- Three bedrooms
- Ground floor bath
- Formal living room, dining room, study
- Attic family room

The couple who own this house both work, sometimes at home and frequently entertain. The attic serves as a play area for their three children. More expensive by nature of its orientation, the couple has contributed to its character through fine wooden trim and details, and elaborate front yard plantings.
PART II: THE SITE EXAMINED

GOALS AND MEANS: A CLARIFICATION OF TERMS

The environment described above embodies many values, in various stages of realization, about what makes a quality living community. For the purposes of this thesis I have chosen a few values or performance guidelines to use as a measure in the development and evolution of the design. Before returning to examine the design in detail I think it useful to reflect on a few of these.

Variety, is used here to describe the form, that the things that we see take on different shapes, textures, colors, and a multitude of other characteristics. There are many levels over which we sense these differences: Within one site the land changes, the sun shines differently on different parts through the days and seasons, types of buildings vary, the arrangement of dwellings within the buildings and rooms within the dwellings vary, the texture of the street edge is rough with porches or recessed entries, or shapes are similar but materials change, or fleeting interventions, a bed of flowers, a chair by the door express the individual inhabitation of the place. We
associate this richness of form with the kind of balance or fit that we see in many older neighborhoods and that we find lacking in many new developments. But in the creation of new environments it is very easy to become self conscious, to let variety become an end in itself. And it is necessary to reconcile variety with the degree of efficiency that we demand, assuring that the variety that we create is meaningful and responsible. Thus we recognize the need to manage variety, not to explicitly state that this is like so and differs from that, but to organize the design so that variety is efficiently achievable as desired.

If we use Variety to describe the form, it is also useful to distinguish the ways that variety appears. I use the word manipulation to describe interventions made during the design stages, major moves that set the framework for later actions. Such later interventions might involve minor changes, paint, plantings, furniture, fences etc., that can be described by the term personalization. And finally I use the term adaptation to describe major changes to the form that occur after inhabitation and reflect a response to changing needs and desires on the part of the user.
The issue of Control is equally rich and confused with multiple meanings. Like variety, it takes on a qualitative aspect in that we associate a condition of congruence between use and control with good environments. We like to control our own environment, make decisions about things that affect us. Places that are territorially vague and undefined are often unused and dangerous. But I will specifically use the term in its functional sense, to refer to those who make decisions about things, who control specific elements and groups of elements in the environment. It is useful here to distinguish participation and those who contribute to the decision process from control and those who ultimately make decisions. Participation may mean nothing more than a sensitivity to context, whereas a separation of control may have profound effects on the form and organization of the development.

The following thoughts concern ways that we might better encourage the qualities of variety and decentralized control that we associate with good environments. The idea that forms and spaces have a capacity to support a variety of uses and interpretations is crucial here. This includes not only the provision of excess capacity, the benefits of which must be weighed
against increased costs, but also the thoughtful arranging of materials and spaces such that they form a context for future action. A site has a certain capacity for buildings, a number of unit types may occupy the same building, rooms support different furniture, or an entrance may or may not encourage personal definition.

Whatever capacity is provided, however, is most useful as an assembly of parts, rather than a unibody whole. This separation of the parts and understanding of levels is absolutely necessary to encourage independent actions by different parties through time. If the window opening is thought of separately from the windows, it may be sized so as to support either a series of double hung windows or a bay or even a pair of patio doors. We can even say that by distinguishing the opening from the window and by properly sizing the opening we can both control variety (the framed opening is always the same, only the windows and panels change) and open the arrangement up to different patterns of control (one party might decide where to place the openings early in the design, while someone else selects the windows later on). The same can be said for standardizing floor openings to support a variety of stair options, and so on throughout the design. Finally, we
must remind ourselves that we must do all this with **ef-ficiency**, that we must balance a gain in some performance with a loss in another. The cost may outweigh the benefits, and ultimately we have limited resources to expend.

**PARTS AND LEVELS**

There are numerous ways of breaking things down, of describing wholes as aggregations of different parts, depending on one's point of view. On what basis and into what parts do we disentangle the many actors and building systems that are all part of life history of the environment we have described. My interest has been in understanding how we make decisions and control variety. I therefore view the parts in relation to the process of decision making. The problem is that if different people are to decide about different things at different stages in the life of the Site, who are these people, when may they decide, and which things can they decide about? I have gathered the people who act into three broad groups, the community and the household at each end and the developers and professionals in the middle. I have collected the various phases of activity into pairs of related yet distinct
activity/times: design and building; use and transformation. Perhaps most controversial is the disaggregation of the form into a kit of parts. These parts have been selected for their relevance to the decision-making process. They represent configurations of elements that we decide about and act on, capable of being controlled and manipulated by different parties at different times. Of course these distinctions do not represent fixed boundaries, many other interpretations are possible. But rather they offer a starting point for exploring and manipulating the design. While information at the site level is presented, it is the elements at the building level that most concern us. Here we will look at the elements themselves, their variations and deployment in the site, and outline relations and dependencies with other elements.
WHO ACTS

Community
- City of Boston
- Public facilities department
- Building department
- Nuestra members
- Neighborhood
- Household association

Developers
- Nuestra staff
- Design professionals
- Contractors

Households
- Individual homeowners and tenants
WHEN THEY ACT
Lifestages in the development and evolution of the site.

Designing
For our purpose we will concentrate on the process of deciding about things, about choosing among the various possibilities that the design offers us.

Building:
This phase entails the assembly of things, the organizational and technical details of building the form.

Use:
The inhabitation of the form, including the character and articulation that is brought to the form through the myriad interventions that are a part of daily life.

Transformation:
A phase of adaptation of the form in response to evolving demands placed on it through use.
THINGS THEY ACT ON:
A KIT OF PARTS

SITE LEVEL

Site Elements
Streets
Parking
Sidewalks
Paths
Front yards
Rear yards
Common land
Park
Playground
Garden

Buildings

Dwelling Units

Rooms

BUILDING LEVEL

SPATIAL SYSTEMS
Bedrooms
Bathrooms
Kitchens
Living rooms
Dining rooms
Storage

MATERIAL SYSTEMS
Foundation systems
Party wall Systems
Bearing Members
Floor systems
Exterior wall systems
Roof Systems
Stair systems
Partition systems
Enclosure systems
Windows
Doors
Panels
Mechanical systems
DWV
Water supply
Heating
Piping
Baseboard
Electric
Gas
Equipment,
Finishes
Decks, Sheds, Fencing
THINGS THEY ACT ON:
A KIT OF PARTS

SITE LEVEL

Site Elements
1. Streets
2. Parking
3. Sidewalks
4. Paths
5. Front yards
6. Rear yards
7. Common land
   Park
   Playground
   Garden
THINGS THEY ACT ON: 
A KIT OF PARTS

SITE LEVEL

Buildings 
- Corner multi-use 
- Row house 
- Free-standing house

Dwelling Units 
- Single family 
- Two family 
- Multi-family

Rooms
THINGS THEY ACT ON:
A KIT OF PARTS

BUILDING LEVEL

BEDROOMS

---

**Fixed:**
- Adjacent to exterior zone

**Variants:**
- Size: single or double occupancy
- Configurations of 1-4 bdrms
- Position at front, rear or side
BATHROOMS

Fixed:
- Plumbing wall and
toilet waste outlet

Variants:
- Alternate location
- Configurations of:
  - Standard
  - Reduced
  - Enlarged
  - Shifted orientation
KITCHENS

Fixed:
- Unit: selected
- Counter lengths

Variants:
- Assemblies of units
- Position of assembly
  - Front
  - Middle
  - Rear
LIVING ROOMS

**Fixed:**
- Adjacent to exterior zone

**Variants:**
- Position of:
  - Front
  - Side
  - Rear
DINING ROOMS
STORAGE
THINGS THEY ACT ON:
A KIT OF PARTS

BUILDING LEVEL
MATERIAL SYSTEMS

FOUNDATION SYSTEMS

PARTY WALL SYSTEMS

BEARING MEMBERS
FLOOR SYSTEMS

- Joist directions allow easy cantilever and adjustment of stair opening.
- Standard interior, varying edge condition.

STAIR SYSTEMS

Varying stair assemblies
EXTERIOR WALL SYSTEMS

- Wood frame with standardized oversized openings to support a variety of window and door configurations

ROOF SYSTEMS

- Standardized treatment with variation at the front edge and side.
ENCLOSURE SYSTEMS
WINDOWS
DOORS
PANELS

- A kit of window, door and panel parts capable of many assembly configurations
- Dimensionally coordinated to wall openings.
A standardization of systems on certain levels with capacity to support variation on other levels.

Fixed:
- Chase location for all services.
- Main Stack and toilet branches.
- Water supply stubs to each floor.
- Hydronic piping stubs in strategic locations.
- Electric junction boxes on each floor.

Variants:
- Vent and waste connection from fixture positions to main stack.
- Water supply connections from fixtures to supply stubs.
- Hydronic baseboard or connecting piping between supply and return stubs.
- Electric fixtures and wiring.
PART III:
FORM AND PROCESS EXPLORING

INTRODUCTION
Having looked at the design in terms of its physical parts, actors and time periods, let us proceed in exploring different models of form and process, based on varying patterns of control during the life of the project. For it is only when we bring these three aspects of the design together that we may fully come to realize the meaning and potential of the design. In the first section we explore how this separation of parts and careful testing of capacity enhances variety and efficiency under traditional one-party control patterns. We suggest that while Nuestra desires to maintain ultimate control over final decisions, they wish to both respond to the demands of other parties in a participatory design process, delegate some control during the building phase, and create an environment that encourages individual identity and expression through time. Then we will extend this discussion to explore how the design enables independent yet coordinated decision-making among different parties over different things. Specifically we will suggest that Nuestra chooses to distinctly separate elements
and powers into two levels, the community / support and the household / infill. This model will be developed at length, with a transformation of the design into a support and infill proposal and a study of the technical implications of these specific support and infill organizations.

**FORM AND PROCESS UNDER ONE PARTY CONTROL**

**PARTICIPATION AND DESIGN**

It is the nature of community based social housing that many parties compete for influence in what is necessarily a complex decision-making and agreement process. The section that follows assumes that Nuestra wishes to be as responsive as possible to the demands of the various parties involved, without permitting inefficiencies and delays to threaten the affordability of the housing. We will explore how the design responds to potential situations where Nuestra would like to delay decisions, fix some elements while allowing others to vary and structure participation during the design phase.
SITES, BUILDINGS AND UNITS

Preliminary discussions with the community, neighborhood residents and the city often revolve around such major issues as building densities, the use and character of open spaces, and the number and types of units that will be provided. Offering a set of parts that are easily manipulable prevents indecision at these levels from restricting design work at other levels. Building types may be grouped together in different ways, open spaces may replace a cluster of buildings, or sites may even change. These issues may be negotiated without fixing the actual number of and type of units.

ROOMS AND USES

Offering a building type with a capacity for a number of different room arrangements and enabling different uses works in the same way. While site and building decisions establish the general mix of unit types we can expect, actual household allocations and decisions about rooms and even uses can be made independently. Detail design work, cost estimating, interviewing with prospective homeowners can all
proceed even as negotiations with other groups hold up final site decisions. Or conversely, early decisions on the site and building level do not restrict these lower level decisions.

BUILDING ELEMENTS
Working with a kit of building elements brings efficiency and manipulability to the design process, and helps to structure participatory decision making. Well defined parts with clear relationships educate participants, speed the process and reduce conflicts. The form itself makes this possible. Wall openings with a capacity for different windows enable participation. Variety and individual expression are byproducts of such a process, not self conscious goals in themselves. Developing a physical kit of parts in model form, that can be readily assembled and rearranged over and over by different parties would be simple and effective in structuring the participatory decision-making process.
BUILDING
Now let us imagine that Nuestra wishes to pursue alternative patterns of control during the construction process. They have stated an interest in employing local unskilled labor and in supporting owner self-help where appropriate, but they also require the efficiencies that large construction organizations or the use of lower cost manufactured components can bring to the job. How might the design help reconcile these conflicting goals? Simply, the explicit disaggregation of the design into parts, with clear relationships and tested capacity allows different parties to act independently with less interference and conflict. Nuestra could hire a major construction firm for large scale repetitive tasks, organize its own crews of local labor to complete lower skilled tasks and subcontract components to prefabricators with less confusion over who is responsible for what.
MANUFACTURED & PREFABRICATED COMPONENTS

We can imagine that under the right conditions Nuestra could purchase manufactured or prefabricated components that could then be shipped whole and attached to the site built shell. Many housing prefabricators make whole bathroom units that could conceivably be purchased by outside parties. Companies manufacture stressed skin panels that could be cut and fitted into openings around windows and doors. Manufactured stair components are common marketplace items and could be bought and prefabricated into stair units.

- Combines efficiencies of mass production of repetitive units with uniqueness of site solutions.
- Allows primary contractor to reduce detailed fitting, adjusting and repetitive fiddling with many different systems.
- Requires a reordering of subcontractor relationships.
- Requires detailing of connection joints
USE AND TRANSFORMATION

The configuration of the design continues to support individual action and control over the form of the environment after design and construction are complete. Such interaction is enabled, structured and made more efficient through the same capacity and isolation of systems that enhanced efficient manipulation of elements during the design and construction phases. We will briefly summarize two situations, personalization at the front and adaptation in response to changing needs. This opportunity for interaction is especially significant in the provision of low-income housing where individual input during design and construction phases is often limited, and resources for post occupancy personalization and adjustment are scarce.
PERSONALIZATION AT THE FRONT

"A house can only be considered a 'home' to the extent that the occupiers can give it their own meaning... 'homes' develop in spite of rather than because of the house design." (Marcus, 1986, 63)

The design contributes to expressions of individual identity through:

- **Territorial definition:**
  - Individual front yards.
  - Recessed entry area.
  - Framework to initiate fences or walls.
  - Management agreements that encourage definition.

- **Separation of parts:**
  - Component windows doors and panels facilitate changes.
  - Deck over entry convertible to living area.
  - Entry paving distinguished for individual definition.
ADAPTATION IN RESPONSE TO CHANGING NEEDS

A dwelling's capacity to respond to the changing needs and aspirations of its occupants promotes long term viability, especially in a context that is rapidly changing. We can expect changes in the size of families, in their income, and in their need for space to support special activities and uses. Many of these changes require little or no physical change. Some require minor alterations or reconfiguration of elements, others stimulate major additions. Again, provision of excess capacity and separation of parts contributes to an efficient transformation process.

- Tested plan capacity and placement of services support additional baths, expansion to the attic, or subdivision of rooms.
- Changing the orientation of stairs, exchanging a window/panel for a door, and adding entry partitions, offers a first floor office or inlaw apartment.
- A foundation framework in the rear yard and a structural roof deck support external expansions in the form of decks, sheds and horizontal and vertical additions.
A SUPPORT AND INFILL PROPOSAL

INTRODUCTION
As the previous discussion makes clear, a commitment to enhance occupant choice and control is fundamental to the organization of the design. Yet the design offers a far greater potential to realize this goal than in merely enhancing participation or enabling post occupancy personalization. Let us imagine that Nuestra chooses to explicitly integrate occupant involvement into the design and building phases of the project. They do this by clearly distinguish two spheres of control throughout the scope of the project, for they recognize that while certain decisions are best made by representatives of the community, others are best left to individual households. Specifically, as a representative of the community, Nuestra might decide to define a support, over which they would exert control during design and construction. After its construction, ownership would be transferred to a household association, consisting of the future homeowners. The support, owned and managed by the association, would be under long term lease to the households. The surface rights and infill components associated with specific lots would be owned and controlled by individual households in an arrangement
similar to that of the typical condominium. Each household would pay both a monthly fee to the association based on the support type that they lease, and a mortgage to a lender to cover the cost of all infill components under their ownership and control. Government funds may be used to subsidize the cost of the support, reducing lease payments to a minimum. Furthermore, since the support is non-transferable, the benefits of the subsidies would be passed on to future owners. The sale price of houses would be restricted to include the cost of infill improvements plus a reasonable rate of return on the investment. Together, these features would help insure that the housing remains affordable in the future.

The design process would be similarly split into two levels. Nuestra would have the responsibility to design the support and test its capacity for a number of infill variants. This would include the kit of parts, from which households could select infill packages. Design of the support would be exclusively controlled by Nuestra, though as we have seen the design easily enables participation and contribution to design decisions by outside parties. Once the building support is designed, decisions about site organization, occupancies, uses and infill designs can be made independently. Thus at any point during this period
Nuestra could assist individual households in choosing houses, deciding on occupancy patterns and designing infill packages. Decisions about the infill options available would be made clearer through the use of kits of parts in models and drawings. The costs of various packages could be quickly assembled to check for compatibility with family budgets.

Nuestra would likewise have the option to control the construction of the support to completion, as distinguished from the infill. Construction of the support may well precede selection of the households, and may even be complete before infill designs are completed.

Many different arrangements may be made for the actual construction of the infill packages. Nuestra may choose to have the support contractor continue through the infill phase, they may contract with a separate infill contractor for the entire project, the family may look for its own infill contractors, or individuals may opt to do portions or all of the work themselves.

In the section that follows we will first present a support design for the rowhouse building type, examine the support and infill plans for one variation of the type, and then explore some significant organizational and technical implications of the support proposal.
A ROWHOUSE SUPPORT
A ROWHOUSE SUPPORT DESIGN

The row house support shown on the previous page represents an assembly of three basic support variants within the rowhouse type, and provides the context for the particular support variant we will examine in detail on the following pages. These drawings represent a support which has the capacity to hold a number of alternatives in the location and function of spaces, and in the form and placement of many physical elements. If at first we looked at the design as a unibody whole, then disentangled it into parts in many levels, we have now reassembled it into two levels, support and infill, based on two patterns of control, community and household. While reviewing these support and infill plans it will become clear that this support/infill distinction is primarily organizational, not technical in nature, in that we will find many of the same building systems within both support and infill.

SUPPORT VARIANT I.A

The support is made up of systems and portions of systems that alone are incomplete but when combined with the infill systems result in a finished house. As defined the support includes complete foundations,

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party walls, exterior facade walls and roofs. The party walls contain an opening on each floor to facilitate movement through the support during its construction, and offer potential horizontal connections during use. The exterior facade walls are framed with oversize window, door and panel openings, and are sheathed but left without siding. The roof includes one skylight, the only window element in the support. The floors are framed with standard stair openings, sheathed, layered with gypcrete, and ready for floor finishes. A plumbing partition comprises the only interior wall framing. Party walls and ceilings are finished with blue board, plaster, and primer.
Mechanical systems are split between support and infill. Support DWV includes the main stack complete with tees for drains and vents and a main branch for a wall outlet toilet. Separate hot and cold supply piping run from the basement service to each floor. Piping for hydronic baseboard is run to calculated positions, separately zoned on each floor. Separate circuits for each floor are run to junction boxes in the partition wall. Support walls are wired independently from the infill.
INFILL VARIANT I.1

The assembly of systems that together make up the infill package is determined by a plan and list of components drawn up by the individual households with the assistance of the Nuestra staff. This includes partition framing on the interior and panels, windows, doors and finish siding on the exterior facade. Hydronic baseboards and connecting piping are joined to the shell piping. Additional supply lines are run from shutoffs in the chase at each floor to the plumbing fixtures, and additional waste and vent lines are run as necessary from the fixture location to the
tee in the main stack. Infill wiring is run from the support junction boxes within partitions, and any other connections between shell and infill wiring is made. Wall finishes are applied. Kitchen and bath fixtures and equipment are installed. Stairs and floor finishes are completed. Exterior decks, patios, fencing, sheds and plantings complete the job.
IMPLICATIONS OF SUPPORT AND INFILL DECISIONS

DEFINING THE SUPPORT

We may define the support as a configuration of elements that is capable of holding a number of different infill arrangements and packages. We may say that it is common to a number of different schemes (the standard around which specific lower level elements vary), that it is usually longer lasting, responds more immediately to conditions of the site and context, and falls under common control and contractual relationships as distinguished from the infill. In reaching a balance between what is support and what is infill, we attempt to maximize the support without restricting its capacity for variation within the infill; or conversely we try to maximize the support's capacity for infill variants, without reducing the support to that of a meaningless "universal" space. In short we are moving through a process of controlling variety, of fixing elements on one level, the support, so as to permit reasonable variation and choice on the second level, infill.
SUPPORT TYPES: A FIRST STEP

In reviewing the site, the first thing we notice is that what we recognize as building types in the design defines a highest level of variation that affects many of the lower level decisions. Thus, recognizing three support types will constitute our first move towards defining a support. The first may be said to be the two family free standing building in which we expect to find a side by side division of territories. The second type is the rowhouse, which permits a vertical division of territories, yet remains primarily single family in orientation. Finally, the corner type offers both a vertical and horizontal division of territories, enabling the most varied uses and occupancies. From these three types we have chosen the rowhouse type for our case study.
THE MINIMUM SUPPORT

In reviewing the material systems identified as components of the design, we find that foundations, party walls and bearing members remain constant throughout the rowhouse support type. However, we find a variation in floor projection at the front of internal rowhouses and at the side of some end houses. It is useful to identify these common forms preceding the variation in floor projections as the minimum support: Those systems of elements that are identical in dimension and position and offer exactly the same capacity for the lower levels. It is at the minimum support level that Nuestra can assure the contractor that everything is the same, standardized, uniform.
VARIATION WITHIN THE SUPPORT

When we examine the floor system we find our first variation within the building type and confront our first decision over support and infill allocations. Simply stated, within a three foot margin in the front, and a similar margin at the end facade, the floor projection can vary. This results in a number of roof and exterior wall variations. While the character of the interior space is obviously affected, the actual capacity of that space for different uses and lower level elements remains the same. Our question is one of control and organization: should the community or the individual decide about the form, and what are the implications of this decision? If the individual decides about the bay projection, this requires that the infill include a much greater percentage of the building than would otherwise be necessary. This conflicts with the general goal of
maximizing the shell and minimizing the infill, and raises a whole host of technical problems related to postponing major exterior enclosure to the infill phase. Furthermore we can argue that the driving force behind the variation at the front is to improve the character of the street and the individual identity of the houses, a community not an individual decision. At the street, the place for individually controlled variation is in the lower level moves within a structure provided by the community; While in the rear, the potential for major alterations is weighted towards individual control. Thus we place floor systems, exterior wall systems, and roof systems in the realm of the support. This decision requires that the support contain a degree of variation within it, a condition which may conflict with traditional thinking which defines the support as constant. It is my contention that accepting a limited level of variety within the support is acceptable.
and constitutes one of the adaptations that the North American context requires. Physical capacity is unchanged, control patterns and contractual relationships remain the same, and a new support type is unwarranted.

**SUPPORT VARIANTS**

Within the row-house type, then we find the following support variants, distinguished by their varying treatment of the outside edge.

**SUMMARY**

In summary, we have defined a general support model as follows: Within the site we recognize three support types. Examining the rowhouse support type in detail, we find that variations within the support result in three basic support variants. And finally, in the household plans we see four possible combinations of row house support variants and infill packages.
SUPPORT AND INFILL SYSTEMS:
PROCESS PLAN AND DETAIL

If as we stated earlier, the design gains its power through a deliberate separation of parts and responsibilities and a thoughtful provision of capacity, then we need to examine the implications of these characteristics in detail. For while the support and infill distinction is primarily organizational in nature, there are technical consequences of reordering physical systems in this manner. Systems may require adjustment if they are to act independently, systems may have to be configured differently to provide the desired capacity, elements may have to be detailed differently to join properly, and processes and procedures may have to adjust to these changes. In the next section we will try to chart some of these issues, looking at plans, and considering the technical and decision making details inherent in the design.
SYSTEM INTERFACES

Charting the nodes of intersection between different systems in support (shell) and infill assists in isolating situations where special details or different configurations may be called for. The implications of different support and infill distributions may be quickly compared.
PARTITIONS

Interior partition framing is delayed until support is complete (including Gypsum board on support walls and ceiling).
- Increases capacity for plan variations, alternative uses and occupancies.
- Allows for independent control over design decisions.
- Enables independent construction methods, manufacturing of components, self-help.
- Increase efficiency without uniformity.
- Facilitates future alteration.
  - Requires minor duplication of action (some walls are part of support also).
  - May cause damage to support surfaces.
  - Requires special detailing at some intersections.

Additional material
- Blocking in support floors, ceilings and walls to support partition variants.

Details
- Attachment of infill partition to support surfaces and infill panels.
- Proper sizing and alignment at connection points.
  - Panel
  - Column
  - Party wall
- Finishing details at joints with dissimilar materials

Partition Composite
STAIR SYSTEMS

The support contains oversized floor openings with capacity for different stair configurations, with stairs installed as infill.

- Enables uniform floor framing and variety in stair/plan layout.
- Supports prefabrication of stair assembly.
- Reduces damage to finish stairs during support construction.
- Allows coordination with floor finish thickness and material.

- Requires temporary construction stairs, though capacity for horizontal movement on each floor minimizes stair use.
- Requires detailing of attachment at support.
ENCLOSURE

Enclosure of oversized support openings with windows doors and panels is delayed to the infill phase.
- Enables enclosure elements to respond to variations in occupancy use and plan.
- Absence of windows during support phase may limit loss of glass due to vandalism.
- Allows expression of individual identity on the facade.
- Facilitates future alteration and expansion.
- Requires temporary enclosure and weather proofing of the support.
- Requires special detailing at intersections.
- Requires that either siding be part of infill, or special detailing of siding joints be made.

Additional material
- plywood to cover openings.

Details
- Attachment of windows, doors and panels to party walls.
- Connections between enclosure units.
- Trim details for adjustment of different units within standard opening.
- Panel fabrication: site built, prefabricated, degree of finish.
DETAIL

Support: Exterior wall with finish skin and window openings.

Infill: Window, door, and panel units, finish skin where required

Problem: How to design support and infill components so as to maximise capacity and efficiency.

Capacity Requirements
1. To provide for plan variations as infill and distinct from support decisions.
2. To allow for window style variations independent of support decisions.
3. To support a range of choice in window manufacturer independent of support decisions.

Plan Capacity:
A. Vertical variation
   1. Sliding doors
   2. Swing doors
   3. Living / dining windows
   4. Bedroom windows
B. Horizontal Variation
   1. Sliding glass doors
   2. All other units
C. Range: horizontal and vertical
Capacity for Variation in Window Style and Manufacturer:

- Window widths type 2, 3, 4. Shell opening is sized for largest, and trim variation adjusts for differences.

- Window style and manufacturer:
  
  A: Pella double hung wood  
  B: Pella double hung clad  
  C: Pella casement wood  
  D: Pella casement clad  
  E: Anderson double hung clad  
  F: Anderson casement clad

A Window/Panel Infill Assembly

- Support opening has capacity for type 2, 3, and 4 enclosure units: doors or windows and panels.

- Infill shown is of type 3 window with choice of two panel finish options.
EQUIPMENT AND MECHANICALS
A support partition and vertical chase contain primary mechanical services and connection nodes for infill equipment.
- Concentrates major mechanical system installation in the support, allowing standardization and restricting infill operations to minor adjustments and connections.
- Enables decisions about the form and location of kitchens and baths to be made during the infill phase.
- Facilitates alterations
  - Requires an amount of excess material in piping, waste and venting.
  - May require change in traditional subcontract relationships and task sequencing.
  - Requires detailing of attachment at support

Additional Material
- Separate zones for heat and circuits for electric on each floor for independent servicing.
- Excess heat piping to support plan variants.
- Electric junction boxes for support / infill interfaces.
- DWV piping in plumbing wall and chase that may not be used initially.

Details
- Requires wall outlet toilet and above floor outlet tub.
- Detailing of electric and equipment connections at party wall.
- Detailing of electric connections, infill control of support fixtures etc.
FLOORS, DECKS, PAVING
In the support phase, the earth outside the entry is left unpaved, the floor deck above the entrance is waterproofed and sloped to shed water, and footings in the rear support a variety of infill deck and extension configurations.
- Allows standardization of the support and promotes individual identity at the entry.
- The configuration of the deck over the entry allows for use as either an outside deck or a continuation of inside space depending on the infill package.
- Rear Footings bring a degree of order in form and savings in cost and disruption to future expansions.

Additional Material
- Footings for extensions, decks and sheds.
- Waterproofing of deck over entrance if used as interior space.

Details
- Attachment of extensions, decks and fencing at support.
- Treatment of shared territory at party wall exterior: establish procedure for alteration and addition.
- Deck / interior conversion kit:
SUMMARY

These brief explorations do not represent a full accounting of the costs and benefits of specific support and infill decisions. They are by no means complete or authoritative. Rather they are intended to suggest the kinds of design considerations germane to the support and infill distinction in this design. The details at connection points, the additional materials called for, and any reorganization of trades, need to be carefully considered and compared to traditional ways of working. Additional costs, if any may then be balanced against both the initial savings in efficiency and the long term benefits of future viability of the support. More work needs to be carried out in understanding these technical and economic implications within the North American context. However, European experience seems to suggest that any additional cost is outweighed by initial savings in efficiency alone, with added benefits when one considers savings over the life of the support.

Lucez, 1985

Kendall and Chalmers, 1986

Habraken, 1985

Lukez, 1986
CONCLUSION

In this work I have attempted to unite an idea about a way of working with a particular context and together develop a design. The idea and context fuel the design and give it form, while the design offers a setting from which to explore the application of the idea. In this respect I would hope that the design fuses both form and process to suggest not merely the form itself, but how it might have originated, developed and changed over time.

The idea derives from the work of SAR in the Netherlands, which declares that variety and user participation can be managed efficiently through a design and building strategy that delineate two levels in the control of space and material, the community (support) and the household (infill). The context is one in which the goal of a community non-profit developer to build a viable community in an open and user responsive way directly conflicts with the need to build low-cost housing with limited resources. In extending the idea to this North American context, I first explored what it might mean to both develop a design of rich capacity and organize its systems into distinct levels, clearly delineating which things vary
and which remain fixed. I then suggested how this organization might encourage variety, structure participation, and increase efficiency under traditional ways of working.

Finally I presented a proposal based on the support and infill distinction, suggesting that placing certain elements under control of the community and others under control of the households might increase user satisfaction, lead to an informal richness of form, promote long term viability, and increase overall efficiencies. A review of specific support and infill systems indicated some organizational and technical implications for the design and building process.

Research and application of the SAR principles has been conducted for more than twenty years in Europe, while questions as to its applicability in the North American context are just beginning to be asked. This work constitutes a mere introduction to the issues that need to be addressed, and more work is required to fully assess the its potential contribution.
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