A Pedagogy of the Base Building: Design Reasoning in an Architecture Studio

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Most buildings experience in their lifetime a certain "open" relationship between built form and human activity. We can observe that different uses can occur in the same form, and the same activity can take place in different forms. These relations are complex and varied, yet appear to have certain interdependencies and regularities at different levels.

This behavior of form in relation to use is operational in practice today, in buildings which are subject to transformation because of changing needs of occupants for which the buildings offer space over time.

A design pedagogy is discussed in this article based on this concept. How do we design with such transformations in mind? How is such a building constructed? How do the various stakeholders in such a building distribute and yet coordinate themselves and the parts they control, so that at any time, the building is whole? What are the regularities and variables in these dependency relations between form and use?

The design of a residential rehabilitation project is used to discuss these questions. Special issues come up in such a use type when it is assumed to be subject to form transformation and change of use. These issues are discussed, and illustrations given of how such designs would be developed and what they would look like.

Teaching Informed from Practice

Teaching in design studios can and should probe the boundaries of implicit practices. While much of design practice - when it is successful and nimble in the trenches of everyday work - must be of the implicit sort[1], it is an important task of design education to move students toward explicitness in designing.

One reason that it is a good thing to move out of an overdependance on an implicit mode of learning and teaching, toward one in which explicit "ways of working" or methods are present, is that the complexity of architectural practice demands it. If designing is seen as the artistry of making agreements so that someone else can build, certainly it should be understood that control of this complexity is crucial to making healthy built environments. Learning to control complexity, as many point out, is a mark of competency in our field.[2]

The second reason it is a good thing to examine designing in the studios is that it fosters among students an understanding - by doing - of what research and practice can have to do with each other.

These ideas are now familiar in the research literature and in professional journals in many engineering, design and management fields. In fact, engineering perhaps more than architecture (with only a few exceptions) the issues of complexity and design methods have sparked new interest in design theory,[3] particularly with the possibility of harnessing computers as companions in designing.[4]

With this landscape in which complexity, explicitness, and design theory come to mind, architectural practice can offer interesting work for studios. One such practice can be found in the design, construction and management of large speculative office buildings. Here, the complexity that comes from a multiplicity of parties and systems - both of which exist in conditions of change - bring interesting issues to us as we formulate and teach studios. These are the basis for the studio case study presented here, in which these issues are transposed and brought to bear on the design of residential buildings.

But some backround is in order to describe in more detail the practice that is alluded to, in terms that hve to do with the development of a more general pedagogy for design and technical education in architecture.

A Familiar, Conventional Practice

Agents involved in speculative office buildings have found themselves making a distinction in design concepts and technology along lines of responsibility (who decides and acts), and change. These agents - client, developer, constructor, architect, engineers, lenders, suppliers, regulators, and so on - each have a role in such buildings coming into existence and adjusting during their useful lives.

Cutting across the functional specialist boundaries of this list of agents, we can often find two groups of agents. These two groupings come to light when we watch the transformation of buildings in their life cycles. On the one hand are the agents who control the configurations of elements shared among all the occupants of the building such as elevator, stairs, building mechanical systems, building structure. On the other hand are those agents who control elements and configurations such as partitions, ceilings, some electrical equipment, and so on, which can be changed without asking the rest of the occupants, or their representative, to intervene. This suggests that in addition to having agents who define themselves along functional lines (architects, engineers, interior designers, managers, etc.) practice has also begun to recognize a relation among agents based not on a professional/functional distinction but according to the levels on which they operate.[5] However, these new levels are not yet functionally defined by single professions.

We also see that the groupings of agents change from the designing and constructing phase, to the phase of use and management. But while agents shift, the levels on which action occurs stays the same: one level having to do with the fixed parts, the other level with the variable parts.

Such an organizational pattern is now conventional, and has a name. The terms "base building" and "tenant work" have been coined to signify the two levels on which agents work.[6] Of course this is not arbitrary, but has emerged from the distribution of responsibility

that accompanies office building development: the agent controlling the base building and its territories, and the several agents each controlling their own individual territories and the elements in each. It is interesting to note that while the levels seem to persist in all buildings of this sort - that is the levels having to do with fixed and variable parts - the grouping of agents may be different. For example, the World Bank controls both the base building and tenant work levels, whereas in an office building owned by a property management group, the tenant work is controlled by other agents other than those controlling the base building.[7]

Base Building Practice Further Described

The tendency for large multi-tenant or multi-owner (condominium) office buildings to undergo alteration - to provide space over time for may varied tenants - has led building professionals to new ways of working over the past 25 years. They are new because buildings experiencing this sort of change - under these patterns of responsibility - apparently have not always existed.[8] As they emerged, lending institutions, regulatory bodies, tenants, and other parties responsible for these buildings shifted their protocols of coordination and responsibility. The design and construction professions, for their part, found themselves adopting new design tools to help them with a new set of constraints. New building elements also appeared in many building systems, most noticably in the resource distribution systems. New electrical and data transmission systems, lighting fixtures, heating and cooling systems, and piping systems have emerged with new implications for design, depreciation schedules, and maintenance contracts. Other systems have also seen new hardware emerge in relation to these emergent processes, including new partitioning systems. These new elements have sometimes successfully displaced conventional elements of the same type.

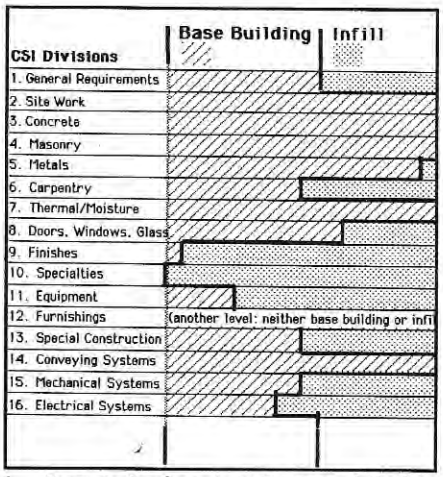
These developments have represented a shift in patterns of responsibility in the way design, construction and management were undertaken. It seems that "lower" powers (tenants or office condominium owners, as compared to the "higher powers" - owners who controlled the base buildings) had begun to take initiative. The "lower" powers, having no interest in making their own buildings, found themselves making agreements with other powers, the "higher" ones, who would build a building. They were, as "lower" powers, free to control certain configurations of spaces and elements in the context of the other "higher" power's configurations and rules. For the projects they occupied - and the investments - to be durable, and the tenants happy, many parts had to be adaptable. A new level of control came into being and a new technical level found its place in practice.

Levels in Practice

This way of seeing buildings as having to do with levels of control is not particularly surprising when we examine practice. For example, we find that large contractors such as Turner Construction Company have special project groups which specialize in "tenant work" in large office buildings built by other firms. Turner also contracts to do "base buildings" and will do the "tenant work" in the base buildings it constructs. Estimators and project managers apparently like to work either way, since they can organize subcontractors, prices, and schedules more effectively, and clients like the fact that the know-how is contained in one organization which can deliver a completed tenant space with all its pipes, wires, walls, finishes and equipment in one contract.[9] (Fig. 1)

This strategy of designing, delivering and managing buildings is now pervasive and ordinary, effecting thousands of office building projects covering millions of square feet of leasable space each year. Also, in government contracting the General Services Administration (GSA) developed guidelines for building procurement practice based in many ways on the same principle, one of them being the Peach Book, which for a time was part of the general procurement processes in the federal government.[10]

In summary, the principle of "base building/tenant work" design is that a new level of control and technical systems is introduced between the building and the furniture.[11] The office building industry calls this new level the "tenant work", a business term. We give it the more general name of INFILL, because it can include building elements and spaces in either rental or condominium projects.



1 Construction Specification Institute Divisions overlaid with the Base Building/Infill distinction of control from: Kendall, Stephen, *Shell/Infill: A Technical Study of a New Strategy for 2X4 Housebuilding*, (Cambridge, Mass., MIT Design and Housing Program, 1986).

A "base building" has its own agents and parts. It will have walls, floors, public stairs, usually a central block of bathrooms, building piping and wiring, most if not all enclosure elements, and other parts of normal subsystems common to all the individual parties who may use the base building over time.

The "tenant" work or INFILL level is composed of the rest of all these normal subsystems necessary to make the individual 'territories' habitable, parts which are free to change without disturbing the base building, but which nevertheless connect to their respective subsystems in the base building (for example, infill pipes must connect to base building pipes, etc.). (Fig. 2)

Several examples make the point. A wall between tenant spaces will - in the context of the building owner/tenant relation - be a "higher level" element, because neither tenant occupying space adjacent to it is free to move it. This is simply a rule of territories. It is a base building element. It does not matter if it is structural or not. This is called a demising wall in current practice. A non-bearing wall inside a tenant space is, however, an element which

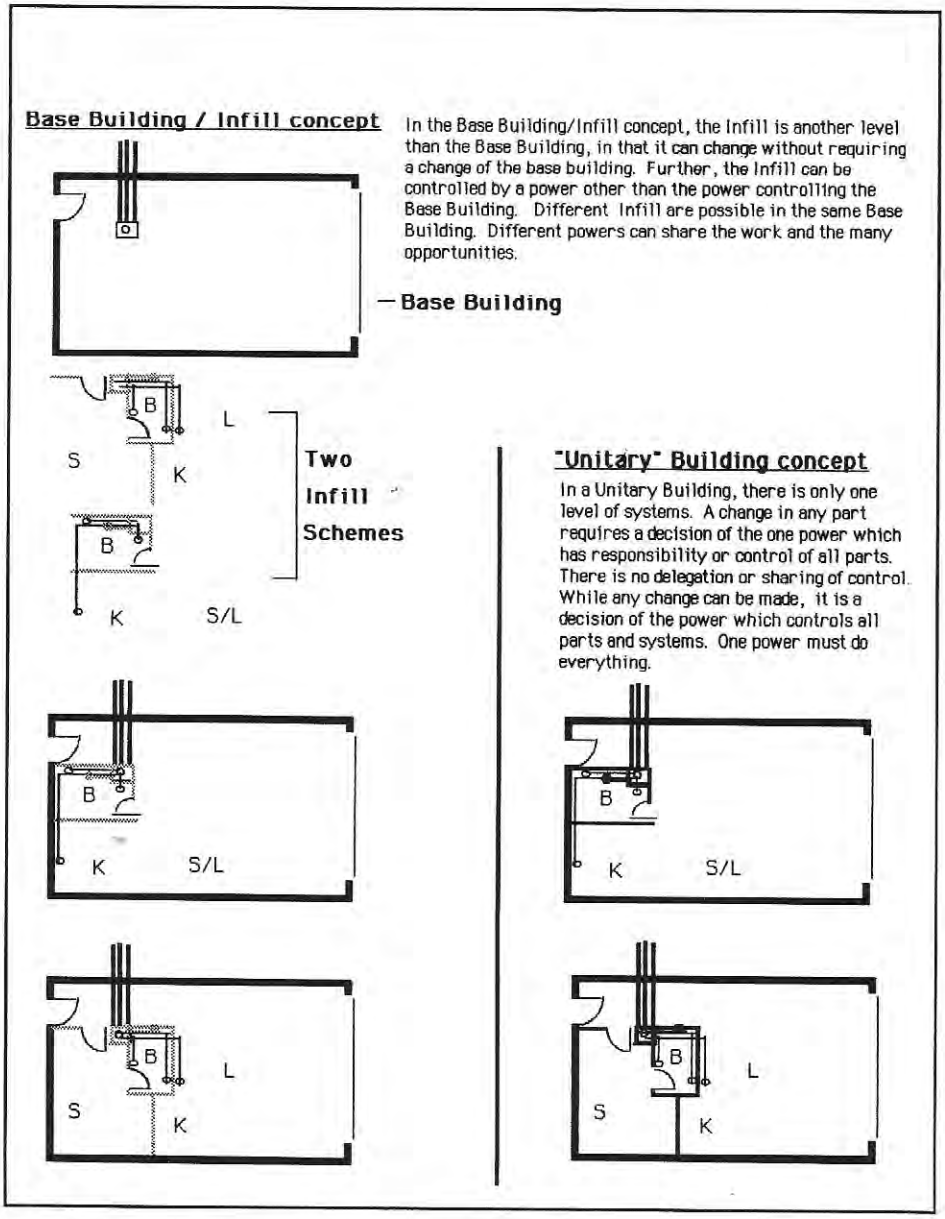
the tenant is free to move, if it is an Infill element; changing it would not require the base building to change in response. In the same way, the same non-bearing wall inside a tenant space, if controlled by the party controlling the base building, cannot be changed by the tenant even though it is physically possible to do so without disturbing other tenants. Thus we see that lower level parts can change relative to the fixed higher level parts, but that the decision about which parts belong to which level is largely one of agreement and distribution of control (right to change). There are important technical constraints which, we must point out, do not always govern.

A Pedagogy of Base Buildings

The artistry of good base building design involves an exacting study, in which the capacity of a base building is evaluated. Just as an electrical system is designed for a specified load capacity, so too a base building is designed with capacity for variable and often unanticipated necessities on the tenant's level. A design method is used (even if not formalized) to find out which variable 'lower level' territories and configurations of physical elements the base building can hold. In fact, discussions with developers reveal that such capacity studies are not required by a developer. When questioned further, we find that such studies are often not even done by their architects.

The concept is general but the buildings which result are particular to a site, a client, finances and local conditions. The operative concept is not first of all a technical one as the examples above show, but is rather one based on responsibility - very much a distinction of "who can control what elements."

Teaching this way of working has clearly become conventional practice in architectural design studios which address speculative office building design. Recently, for example, the former Denver office of Skidmore Owings and Merrill (SOM) conducted a number of studios at the College of Environmental Design in Boulder. SOM has one of the longest records of designing office buildings, and had much to do with formalizing the strategy noted here over the past 25 years.



2 Base Building/Infill Principle contrasted with a "unitary" concept of buildings

In the SOM studio, much attention was spent showing students about conventional thinking in 'floor plate' design, 'core' design, and 'building envelope' design. Various organizing grids were tried, relating to ceiling and environmental control systems, lighting layouts, office partitioning and furniture systems, and spacing of mullions on the building skin. Tenant space layouts were explored, to find out if the 'floor plate' was a good one for the anticipated market.

In general, the idea was apparently to teach students to fix some configurations, and then to study the variability of 'habitation' or layout that was possible in relation to that pattern of constraints. The process is more or less systematic, more or less efficient, and largely driven by conventional practices, available technology, and marketing in the office building sector where the building will be built.

Organizing a design studio to teach this practice usually means - as with all studios - that some of the most important course material will be implicit. That is, there may not be an attempt to bring to the foreground the various rules and procedures for designing with this sort of change in mind - the change we observe in everyday environments as people live in and care for them. Examples of 'good' buildings, will be found, plans will be examined and measured, and a few examples of possible tenant spaces will be illustrated. The design work will move from general programming, to schematic, preliminary and then final drawings and models. Much of the "method" for doing this will remain implicit. That is what studios generally seem to do.

Making Explicit What We Do in This Kind of Studio Teaching

The studios the author has taught recently, growing out of a pedagogy of the base building, seek to open up this tacit dimension. Once we move out of the implicit mode of teaching toward addressing what we do in explicit terms -*to design with change in mind, because that is at root what the "base building/infill" distinction is about* - the teaching changes in marked ways.

First, bringing *methods* into the studio 'way of working' is one alteration to usual studio conduct. It turns out that this can be problematic. It can disrupt the implicitness that ordinarily suffuses studio learning and teaching. Such disruption needs to be understood. Questioning the dominant culture has its costs and its responsibility. Abandoning the master/apprentice paradigm is difficult for students accustomed to it.

Second, it is different from the usual studio which keeps the issue of change, variety, and the concept of control behind the scenes. Instead, there is an explicit attention paid to this topic, which is distinctly not 'cool' and neutral. Students and faculty have become excited with ideological fervor when these concepts are introduced. We see how hard it is to take a more detached observational stance - to withhold immediate and constant judgments that we are prone to make, and to just observe. The subject of control becomes especially interesting when "the architect's" ideology of total control is being questioned.

Third, this way of working makes explicit the two interactive sides of the shared/private, or group/individual relationship in complex environmental forms. We are familiar with these terms, but their ambiguity has always made operationalizing them difficult. Assigning control of building parts to, respectively, group agents and private agents, the relations between group and individual into sharp focus. The principle is that people act in relation to each other *through the built environment* which both shapes and is shaped; giving us the Janus principle in the field of environmental form.[12]

Fourth, this way of working on building design provides a pedagogic setting in which matters of architectural technology have an especially active presence. When we think of buildings as dynamic artifacts which change because people act, issues of what technology to use and how to build become very interesting.

These are the kinds of issues that one thinks of as central in an architectural or environmental design education: *people* (action, operationalized as control) and *artifacts* (Building systems, hardware, and assembly processes) *considered as having to do with each other.*

Hurdles to Cross in Giving Studios an Explicit Dimension

But that which may be implicit in practice should be made explicit in teaching. The question remains whether studios - as a dominant culture of teaching living largely in the implicit master/apprentice mode - can absorb this.

The reason this is important to consider is that, in the main, we work in a studio tradition in which students are not usually, but certainly could be, led to conceptualize their designing as a question of exploring constraints.[13] We also find that only rarely do we lead students to think of and work with the artifact they are designing as being bound up in the passage of time and change; this is mirrored in the paucity of graphic conventions by which to enable this attribute to be 'seen'. Also, students are even more rarely taught to see correspondences between form and building systems, territory and space, and style, in terms of patterns of responsibility or control.

We do seem to have a tradition of teaching students early-on the notion of a rather rigid relation between "a single program" and a "form" or building design. To this we often add an understandable but misplaced wish to make time stand still and change to cease, at least in relation to environmental form, and particularly change initiated by agents other than ourselves. People want to *keep* control because, they say, "someone will mess up 'my' design". On top of this, we provide only scanty help in teaching methods of negotiating agreements among the multiple powers each of which has a stake, over the years, in the buildings we are asked to help design.

A Pedagogy of the Base Building for Residential Projects

Despite these tendencies to ignore issues of change and control, an implicit "pedagogy of base building design" appears to be already in place for the studio instructor who wants to 'do' speculative office buildings.

But the same pedagogy for the design of residential environments has yet to mature, and for good reason.

Architects and other professionals have a long and apparently undying tradition of adherence to an ideology of presumed superiority in design judgments about "housing" and how people should live. "Housing" is a perennial favorite for the indulgence of so-called 'creativity' and sometimes benign, but often pernicious professional domination. Professionals seem regularly to presume that, in the field of environmental form and living space layouts, their values are 'better' than other peoples'. Apparently many academic fields are prone to adopt this perspective.[14] There is, of course, a growing literature which questions this, while supporting the proposition that professionals and in particular designers have an important role nonetheless.[15]

Experiences with studio teaching, and also with teaching a lecture/lab in building technology, indicates that confronting this ideology of professional domination and fixity, and introducing a counter-concept which can be named "the base building' principle, leads to constructive discussion, questioning of stereotypical roles and values, and important learning in design reasoning and architecture systems thinking.[16]

One of the reasons this subject is interesting is that students often come to studio work already indoctrinated with the notion that self-expression and creativity are the principle marks of a successful architect. While self-expression and creativity are certainly crucial aspects of designing, these activities are by no means the distinguishing mark of the work of designing built environments.[17] Designing is perhaps more critically a social process in which plans are made on the basis of which someone else can build. There is a crucial dimension of 'agreement making' and 'coordination' in this, perhaps more to the point than self-expression, though not devoid of it.[18]

The attitude about designing which places self-expression exclusively at the center apparently needs to be reframed, if the conceptual power to manage the complexity of the 'base building principle' is to emerge and flourish in designing. It may in fact be especially appropriate in residential design, where market forces alone point to the need to manage complexity and variety with efficiency, where cost margins are much narrower than in most office building work, and where variation is much more "fine-grained". The present complexity we observe in residential design and construction suggests that architects do not need first of all to introduce more expression, complexity and variation, but need rather to understand the variety that authentically in the design situation, and to organize it more effectively.

Of course, saying this does not discount the importance of good ideas and creativity, but only suggests bringing these necessities into perspective with other necessities of practice.

This is where the "base building" concept may be useful in teaching design studios dealing with, among other topics, residential design and construction practice.

A Case Study in "Base Building" Pedagogy: Housing Rehabilitation

The architecture studio discussed here was undertaken in the Spring of 1988, at the College of Environmental Design, University of Colorado, Boulder. Fifteen students were enrolled in what was, for many, their first 'architecture' studio.

The project involved rehabilitating - "opening up" - existing apartment buildings in Denver. We aimed to transform them into buildings that we could recognize as "base buildings", in which variable programs or dwelling unit mixes could be realized.

There were several learning objectives in the studio. We wanted to learn to observe and understand existing built form, from the point of view of constraints these existing configurations have on variable uses. We sought to learn to manipulate and transform built forms, to explore how and in what ways different 'higher level' configurations constrain and enable variable 'lower level' forms and uses, related explicitly to levels of control. We wanted to understand how to manage complexity in designing, when more than one party is involved, in roles of control and/or roles of influence, and in which both fixity and change are factors. We also wanted to explore the technical implications of this way of working, particularly in relation to the resource distribution systems, building structure and facades.

Getting Started: Building Observations

Teams of three students identified typical apartment buildings in Denver, one from each of 5 time periods between 1900 and 1980. This meant searching historical archives, the Denver Historical Society, and the neighborhoods. Five buildings were identified. Unfortunately, the Denver building department does not keep building plans of buildings it has permitted, nor is there any thorough research on apartment buildings in Denver according to plan types, although some work, which we used, has been done elsewhere.[19]

The students conducted observations on these buildings, obtained plans and other drawings, if they could be found, or measured the buildings, found out what technical systems were used to build and service them, photographed and made drawings and built scale models of the buildings in their sites. Students talked to building managers, residents, and building officials in the Denver Building Department to find out more about the buildings' past and their changing uses and occupancy over time. Some students were able to go into apartments. Some buildings had undergone renovations or conversions from rental to condominium units at some period in their history. All had distinctive stylistic 'appointments' and belonged squarely to historic periods which shared style with other widely dispersed places in the US and abroad.

Getting Started: Basic Concepts

Change

The next stage of work began with a discussion of concepts that students would be expected to become familiar with through the studio.

These concepts suggest that architecture for dwelling environments, if it is to have any lasting value, must have parts that can change; and that to be socially healthy (as well as attractive and marketable), a dwelling environment should recognize and support the exercise of power by households over the

cultivation of their own 'territories.' The point of this is that some important parts of a building may be of a sort to last for 100 years. Other parts may last for 30 years, or 15 years, or less. The buildings which students found and documented exhibited this.

These buildings, however, also exhibited the familiar dilemma that the parts with these different life cycles were often wildly entangled, making alteration or variation expensive and time consuming.

We found that the distinction between those parts which last longer and those which do not last so long has to do with many things. These include issues such as durability, changes in codes and regulations, the "market" - that is, what kinds of households seek what kind of dwellings - with particular unit sizes and layouts - in the area (often changing itself) where the building is located, and what will the market will bear in rents or sale prices for condominium units.

One might construe these issues to have an 'objective' side; that is, someone may choose to conduct a technical analysis of a building, or a marketing analysis, collect and analyze data on rents, property values, demographic trends, and building conditions, and show that a particular building alteration or change is needed.

For example, the US Department of Housing and Urban Development recently initiated a series of studies on the modernization needs of public housing. It classified its estimates of the 1.3 million public housing units in terms of seven types of modernization, including basic repairs or replacement of systems, making additions to insure long term viability, and redesigning or reconfiguring to improve projects in order to make them viable in the long run. For each type of modernization, a cost estimation model was developed.[20]

In the end, however, the changes that we see in buildings occur because someone in a position of control decided to act. What objectives the agent(s) had, or what motivated that agent to change something, often remain elusive even if we choose to ask.

Control

In any case, it is perhaps most interesting and useful to observe these changes from the point of view of the built environment as a changing and living entity which 'behaves' in certain ways. This behavior occurs when people act - thereby exercising control. We know the control people exercise by observing changes they make. We do not know the reason for the change we observe with the same certainty but we could say that the values of the party controlling are instantiated in the changes that occur.

Fixed and Variable

We have found from observation that the same multi-family building may exist with different patterns of control in its lifetime. Any rehabilitation scheme gives evidence we can study. For example, in a rental building, we usually find all walls, floors, facades, resource distribution systems and equipment controlled by one power - the "higher" power. Only furniture is under the control of the occupant in most cases. It is, in other words, a building with "unified control". There is no infill level. In a condominium, we find two levels of control corresponding to these very same elements: some of the walls and some parts of the resource distribution systems are at the "higher" level; other walls and the rest of the resource distribution systems are at the "lower level" - the owner of the dwelling can change them without making the neighbor or the building owner change the configurations under their control. (See Fig. 2)

In a rental property, all systems are "variable" when viewed from the position of the property owner; from the tenants perspective, these same elements are "fixed." In a condominium, an owner of a dwelling will understand that some of these same physical elements will be theirs to control - they are "variable", while the rest of the same subsystems are "fixed". In these different control patterns, some parts are fixed and some parts are variable, *in relation to the level of control at which they exist.*

It is almost never the case that this distinction is clearly delineated in multifamily residential projects now being designed and built. Almost always, these buildings are designated as "unitary" building (the equivalent term "integrated" is receiving wide use again, supposedly having to do with technical rationality, but really a description - albeit unwittingly - of control) from a program which, if it considers change, does so in a purely mechanical way - usually called 'flexibility' - not the change of everyday living.

Getting Started: Building Sweeps

Following the documentation phase, students decided to continue working with the buildings they had begun to learn about: three students continuing to work out their own explorations on each of five buildings.

The first step in rethinking the buildings was what we called *building sweeps*. We conducted investigations by selectively removing certain elements and configurations. Students were instructed to make certain moves with the buildings as found (See Figs. 1 & 2)

1. remove all interior non-loadbearing walls; leaving all stairs and plumbing points (those places where supply and drain pipes, ventilation ducts, and so on penetrate through floors, as they found them); then
2. remove all stairs and 'territorial walls' (walls separating current apartments, and between apartments and common spaces like halls), leave bearing walls and plumbing points as they were found; then
3. remove only walls inside existing 'territories' or apartments; remove plumbing points; and then to
4. remove certain portions of floors, to make room for stairs between floors (making two story territories possible).

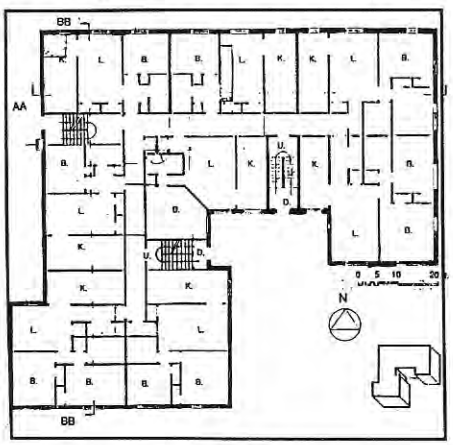
These exploratory 'moves' were to be done one at a time, then combined as apparent benefits from each sweep came to view. The configuration of elements and spaces remaining after each sweep was to be the "*fixed*" configuration. Anything added or done later was "*variable*".

There were two tasks accompanying each move. First, the job was to study the capacity of the resulting configuration of elements (walls, floors, windows, and so on) to 'hold' typical

dwelling 'functions'. What *positions* could bedrooms take, or living rooms, or bathrooms? What *dimensions and proportions* could these spaces be given in relation to these fixed elements? What *combinations or arrangements* (adjacencies) of these activity spaces could be organized - next to the window wall, or near the inside wall by the hallway door - and so on. Overall dwelling 'territories' were not defined at this stage, only the exploration of 'fixed' configurations to 'hold' normal functions (known by their furniture and equipment layouts, diagrams of which I provided).

The second job was to investigate what would be possible in terms of variable dwelling 'territories'. Given what was learned in the first studies, could several small dwellings be made in the same space that would hold one bigger dwelling? Could a space holding two large dwellings also be useful for one big and two small units? What adjustments could be made to enable these variations? The students were provided with examples of this way of working in slides from other student studies and built projects from many countries, and they were given handouts showing space areas and functional areas in a working sheet format to help them think of the relation between simple function areas, composite function areas, rooms and 'sectors' in a base building. (Fig. 3)

These explorations were done, with varying degrees of success and rigor, for each of the four sweeps listed above. It was very hard work, requiring discipline, concentration, and resistance to strike out in what we called "big form moves." The work involved relatively "small moves," some, however, with rather large programmatic implications. The results were not always successful, particularly with students who had little background in understanding dwelling layouts and residential form types.



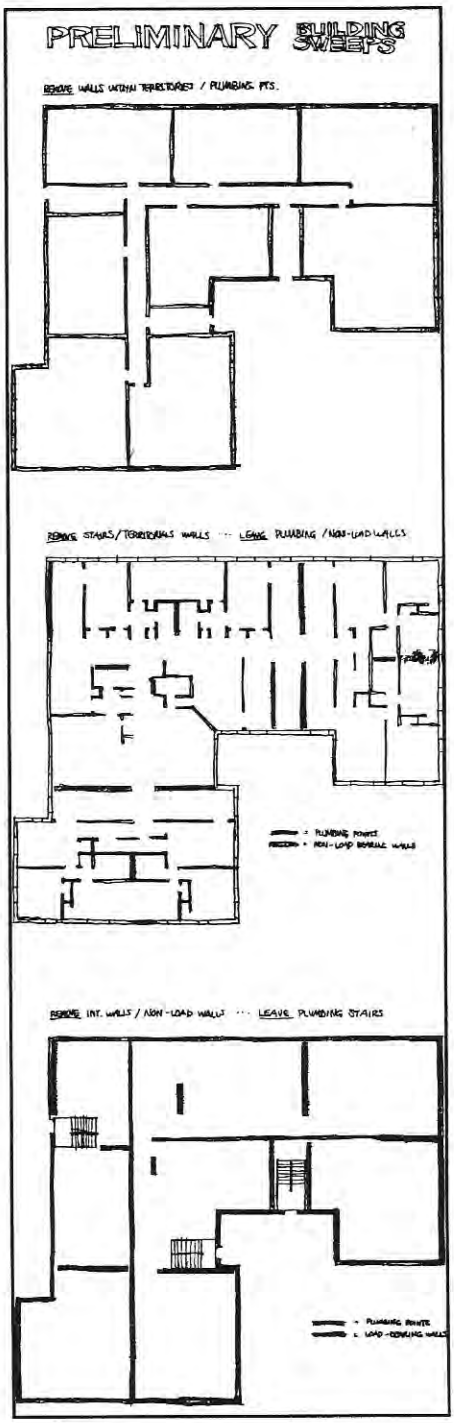
3 The Anderson Apartments as they were found by the students

But out of these exercises students began to understand how to think differently than they had thought about designing before. It was a kind of design *reasoning*,, in that it had to do with *rules that could be and were formalized.* An interesting thing that students found was that they could make their own rules and work with them, then change the rules and keep track of their work as they entered more complex forms and territorial patterns. They also found that the rules allowed them to work together in more supportive ways among themselves.

Some students began to generate so many variants that it became difficult to organize them. For these students, there were clearly too few 'rules,' either coming from the form appearing on paper, or those rules which might be suggested by considering possible 'uses,' 'zones,' or other performance considerations. For them there was encouragement to "fix" more, to push the base building, leaving "less" to Infill. Some students, on the other hand, had trouble generating more than a few territorial or programmatic alternatives, partly because of a difficult building, partly because of difficulty with the concepts. These students were often encouraged to push the "infill," to open up more, to 'fix' less.

Everyone finally learned to generate several different territorial distributions and useful floorplan layout variants in given territories. (Figs 4, 5, 6, 7)

Part of the difficulties students have with these concepts, it appears, have to do with styles of knowing or learning. Some students were quite adept at visual thinking - for them, forms on paper 'suggested' possibilities. We could say the representations "talked back" to them. Others, perhaps better at 'auditory' thinking and learning, or 'haptic' learning (doing)



4 Three "building sweeps" conducted by Thomas Schmidt for the Anderson Apartments Project

found these exercises very difficult. For them, working on actual buildings, or at least 3-D models, might have been useful.

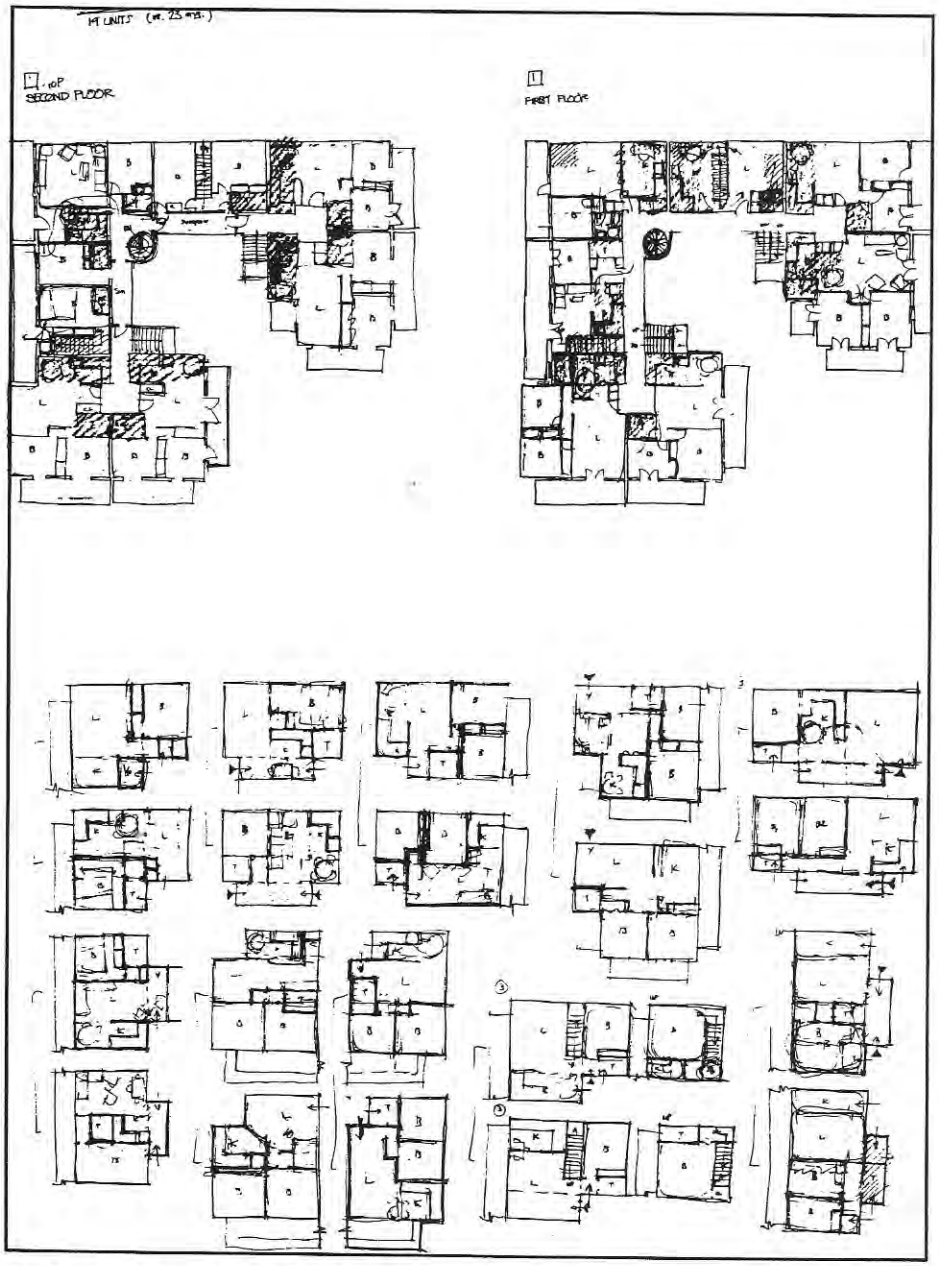
Part of the difficulties came clearly from the particularities of the buildings being explored - circulation organization, depth of building from facade to interior corridors, sizes, proportions and arrangement of windows, location of what we called 'plumbing points', ceiling and floor-to-floor height relative to construction type, and so on.

The 'plumbing point' became a difficult constraint. As the studio progressed, we made every effort to consolidate - in carefully chosen positions - main supply and waste lines, ducts and wiring in vertical stacks running through the floors, serving as many dwellings as possible to be efficient. From these 'fixed and repetitive positions of resource distribution systems belonging to the "higher level" (which could therefore be standardized assemblies for an entire building), students were asked to explore variable positions (and sizes/proportions) of bathrooms and kitchens and other spaces, considering how to route the "variable" or "lower level" or infill supply and waste pipes and ducts in relation to 'base building' elements (mainly the floors, but also base building walls, and of course the base building portion of these resource distribution systems).

Trenches in wooden floor systems, with open tops exposing spaces between joists, emerged as a strategy. Some proposed raised floors as infill elements just where needed. Some students put in too many plumbing/ventilation cores and were cautioned about cost and redundancy. Some fixed the position of the toilet and bathtub, and let the bathroom lavatory position vary, as well as the bathroom size and proportion; some fixed the position of the kitchen, while others left it variable.

The rule they all shared was to keep the pipes and ducts in an occupants' control in that territory. (Fig. 8)

The critical point was that part of these resource distribution systems belonged to the base building, and part to the infill. It was against the rules and the concept to drill, cut, or otherwise destroy any base building part to do the infill work, although these elements



5 Three studies by Thomas Schmidt of variable dwelling layouts in the same territories in the Anderson Apartment Project

certainly had to connect to the base building systems of which they were part. So the base building resource distribution systems had to be very carefully positioned, if more than one floor plan was to be enabled.

Putting this Way of Working into the Students' "Tool Kits"

With six weeks remaining in the term, the students were instructed to put the way of working that they had been learning into their tool kit, and to get on with the job of organizing a "Feasibility Study" for a fictitious developer.

They were told that a developer needed a study of the building she was interested in acquiring, and that their job was to inform her decision by showing how the building could be restructured to give it renewed use into the future. Good design, marketing decisions, construction efficiency, and long term "exploitation" decisions were paramount. They were explicitly told not to make a point of the way of working that they had been learning, but to show results. If someone wanted to know how they had come to the results of the study, they could be shown.

In the intermediate review of proposals, many were questioned as to functional adjacencies and room sizes in dwelling units. Several architects in the review questioned the need for variety in apartment layouts, and questioned the need for multifamily buildings to be restructured to enable them to hold variable programs of units, and questioned the concept in general, which some felt was only diminishing the architect's role. Some discussed the difficulty of what, in the industry, is called selective or 'component rehab'[21], and stressed the added cost of selective vs. gut rehab. Some projects were criticized for lacking any "architectural concepts."

During the final four weeks of the studio, there were two goals.

First, students were instructed to engage other faculty, neighbors, or families as surrogate households, and to conduct an exercise in which these households would work with the students to lay out a dwelling in the base building they were working with. This was to move the capacity study work outside the thinking of the students who were also trying to make base buildings. Also, students in the class, working on the same building, were engaged to do the same exercise, as well as students working on other buildings.

Secondly, students were asked to come to grips in much more detail with several 'technical' realities. These included issues related to the routing of resource distribution systems, as well as issues of building structure and construction practices, and such design moves as adding balconies enlarging windows, and cutting stair holes in existing floors.

Final projects, some illustrated here, do not generally show the 'flair of style and poetry' that many expect in studio projects. Issues of style had, in fact, been discussed during the studio, but had not been the emphasis. We had focused on a reasoning process that had to do with the interplay of form, use and technology from the point of view of control and change.

Base Building Pedagogy Enlivens Technical and Design Questions

In general, the base building/infill distinction enlivened many discussions about design principles and intentions. Putting change, control and variation at center stage brought new questions which students found both difficult and challenging.

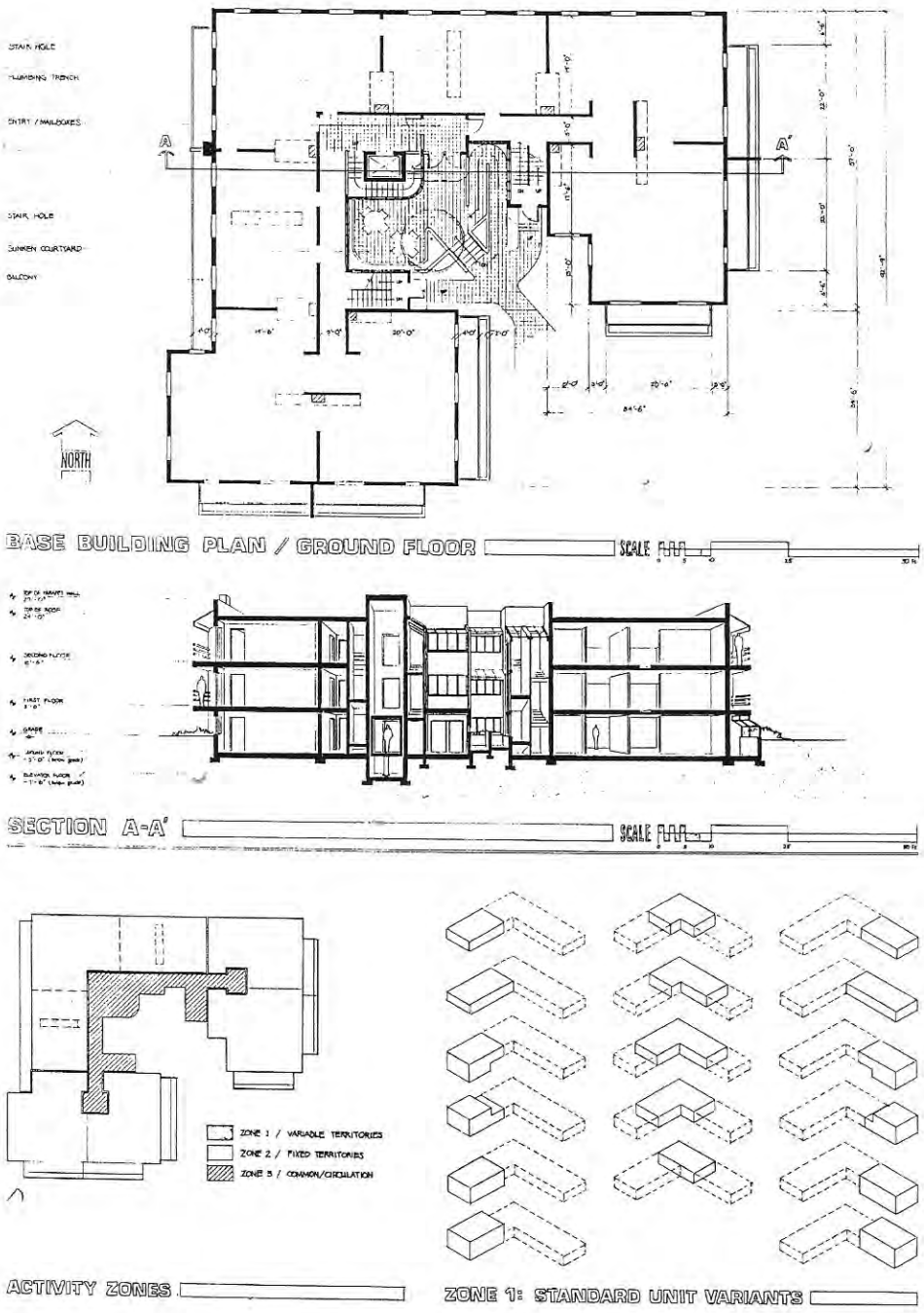
Of particular interest and importance, in the area of linking design reasoning and building technology, was the issue of the "plumbing point." When asked "how does it really work....how do you really get infill pipes and ducts, walls and wiring routed and connected to their "base building" counterparts?" it became clear that students really did not know. They were asked to draw these subsystem interactions in exploded or axonometric sketches, in plans and sections. Questions came into the discussions about how plumbing systems work, where traps are positioned, how waste line venting works, how ventilation ducts run, and so on. These explorations led students into the various building codes as well as construction logistics and practices. These detailed technical and 'resource distribution systems' questions brought into doubt earlier assumptions on plan variants and base building decisions. Adjustments were made from these technical studies and from the results of the 'consultations' with surrogage households, as well as from construction site observations.

Other technical questions came up and needed to be addressed. One student, working on a large concrete frame building found it necessary to alter the facades. She found it could give important benefits at the INFILL level to regularize the window openings (allowing, she found, different window units, if need be, in the same opening). She had to learn about breaking into exterior masonry walls, placing new lintels, relocating radiators, and so on. Other students found that, in thinking about routing rules for infill piping, the direction and depth of floor joists in wooden floor structures became an issue. Some proposed selectively reframing parts of floors to enlarge base building capacity. New stair openings were sometimes proposed, leading to consideration of how floors are structured. Two students proposed putting parking in existing basements. Both failed to make the idea work, because of existing structural patterns.

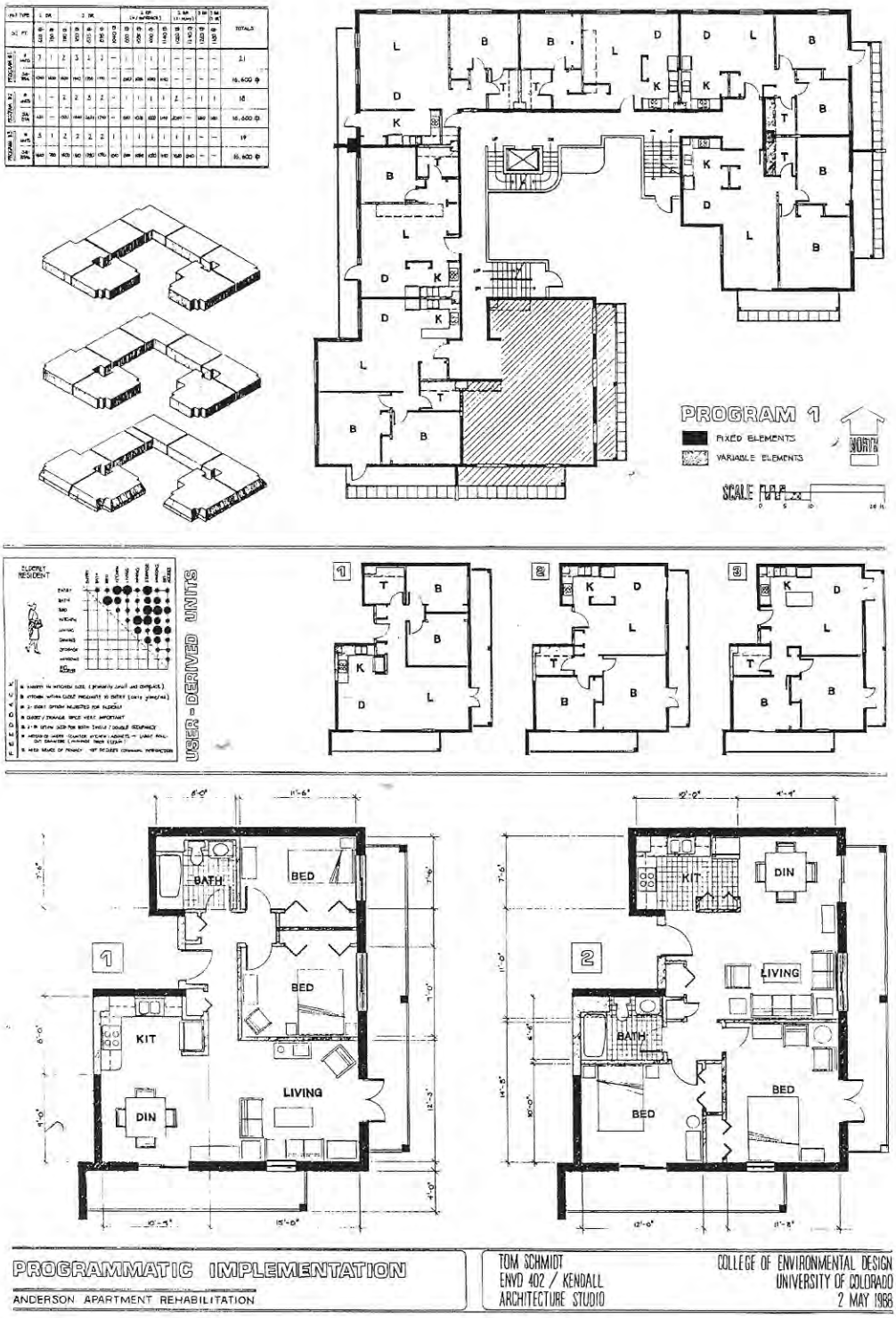
Reflecting on the Studio

This way of teaching studio, and the concepts which the students were asked to become familiar with, provides interesting possibilities for continuing study. The concepts of *change, variety, control and elements* as discussed here, come together in ways which gives a very practical dimension to the studio work. This focus apparently leaves open questions of style, historical reference, symbolism, and many other issues that students each bring with them and want to explore.

Because we chose to look at designing, construction and management from the point of view of control and change, we could see building design, architectural systems and construction logistics from a new and helpful perspective. It was probably in linking design reasoning - a methodical exploration of images - through formulation of rules, to clear thinking about architectural technology, that the studio gave its most useful results. The choice of a rehabilitation/revitalization project instead of a new building constrained the students' explorations in the expected ways. We could and did focus more closely on fewer design moves, and that in itself was valuable for students at



6 The Anderson Apartment's new base building and its dwelling unit variants by Thomas Schmidt

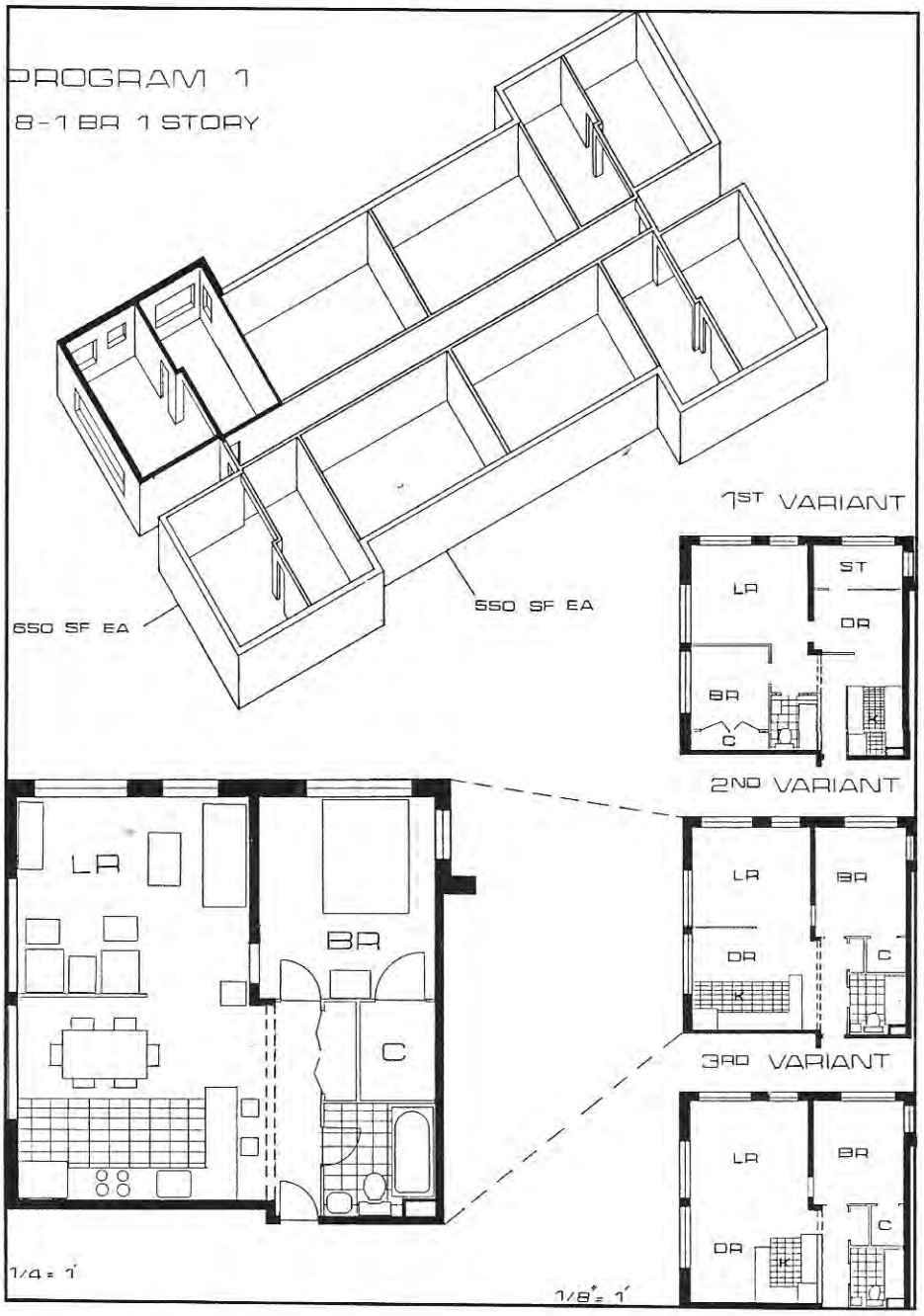


7 Two alternative programs (mixes of dwelling units) that can be accommodated in the Anderson Apartment's base building. Thomas Schmidt.

their point in the curriculum, in their effort to gain new competence and confidence in designing.

The problem of bringing methods explicitly into a studio culture dominated by an implicit way of working remains problematic. Is there, instead, a place for design methods workshops distinct from studio? Could early courses now called studios be rethought as workshops dealing with methods, followed by upper level studios modeled on practice, in which greater complexity is brought in and full synthesis is the objective? Can methods workshops and studios run parallel in 'packages'?

The studio reported on here borders on what could be called a workshop. We dealt with a particular way of working through attention to the rehabilitation of existing buildings. We did not really push to make a full synthesis of each proposal. Many things were left out. It would be instructive to follow students in later years, to see the extent to which these new tools were useful to them as they dealt with more and more complexity in subsequent courses.



8 The Panama Apartments new base building proposal, by Jon Tucker.

Notes

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2 N. John Habraken, "The Control of Complexity," *Places* vol. 4, No. 2 (1987), pp. 3-15
3 American Society of Mechanical Engineers, *Proceedings of the International Congress on Planning and Design Theory*, (Boston, 1987)
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5 N. John Habraken, *Transformations of the Site* (Cambridge, Mass, Awater Press, 1983)
6 Discussions with Robert Holmes, Partner, Skidmore, Owings and Merrill, Washington, DC.
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8 Ibid; also discussions with Dr. Alton Penz, Staff Vice President, Research, Building Owners and Managers Association International (BOMA), Washington, DC
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11 Habraken (see Note 5)
12 Arthur Koestler, *Janus: A Summing Up* (New York: Vintage, 1978)
13 Mark D. Gross, S. Ervin, J. Anderson, A. Fleisher, "Constraints: Knowledge Representation in Design" *Design Studies*, vol. 9, no. 3, July 1988.

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15 Reference is made to the work of N. John Habraken, John Turner, Colin Ward, Amos Rapoport, Martin Pawley, Christopher Alexander and others; also a growing number of practitioners in a number of 1st and 3rd world countries.

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20 Abt Associates, Inc. "Study of the Modernization Needs of the Public and Indian Housing Stock," (Washington, DC., US Department of Housing and Urban Development HUD-1130-PDR, March, 1988)

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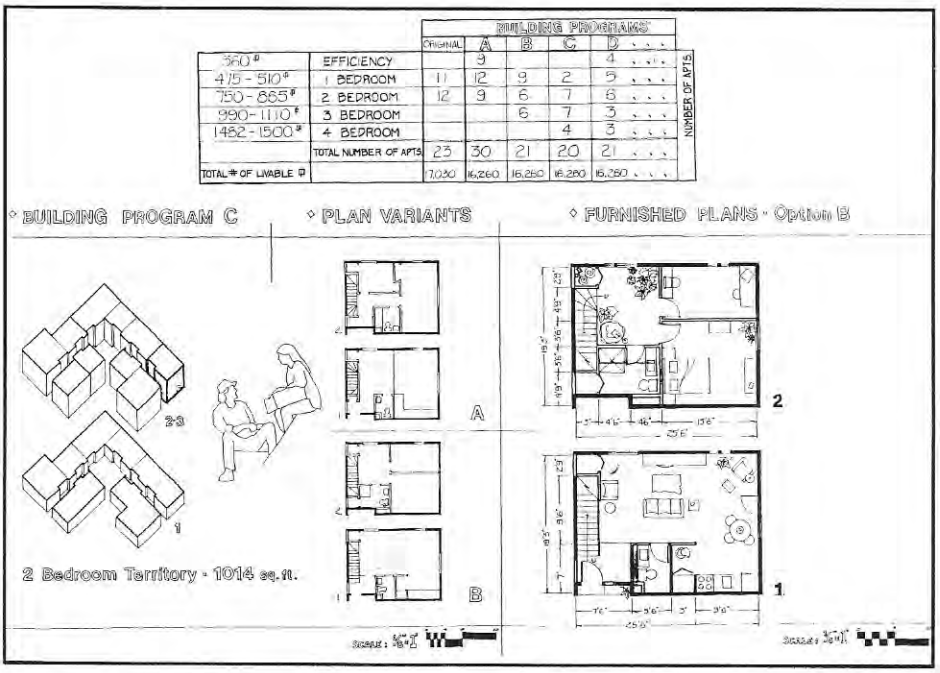

9 Two building programs in another scheme for the Anderson Apartments, by Laura Yanoviak.