Design Pedagogy Contained:
A Case of the Kit of Parts Approach in Beginning Design Education

GU DAQING
VITO BERTIN
The Chinese University of Hong Kong

THE KIT OF PARTS APPROACH IN BEGINNING ARCHITECTURAL EDUCATION

The kit of parts approach refers to an established teaching method in beginning architectural education. It refers specifically to the "nine-square problem" kit developed by John Hejduk and Robert Slutzky in Texas in late 1950s and later at the Cooper Union School of Architecture. It is a set of wooden blocks of different shapes and dimensions representing basic architectonic elements: column, beam, wall, and roof. Exercises derived from it are specially developed for teaching beginning architectural students about spatial organization and construction. As influential as the "nine-square problem" is the set of basic exercises on the modern concept of space developed by Bernhard Hoesli at the ETH-Zurich. A similar case can also be found in Jonathan Block Friedman's course at the School of Architecture at New York Institute of Technology. Here a kit of parts as Hejduk's is adopted but for a more integrated studio program. A series of exercises is developed for several fundamental objectives: tectonic construction, visual language, and model-making and graphic skills, etc. The kit of parts approach emphasizes the manipulation of given "parts" with a clearly defined target. Its pedagogic ideology is deeply rooted in Froebel's kindergarten education, so called guided play. As such, the kit of parts approach has a potential for a rigorous beginning design program as not only the content of training but also the operational procedure of studio instruction can explicitly be predefined. Judith Bing points out that, the kit of parts approach "provides a lucid learning sequence from basic principles to enriched composition, while giving a vehicle for building a strong skill base." But, she further comments that "the abstraction inherent to most design kits denies architecture's essential complexity, and offers too limited an introduction to the design context our students should experience." Here, Bing raises a challenge for design teachers who are working with the kit of parts approach. That is how to achieve the goal of design complexity through a rather abstract teaching tool.

The teaching experiment presented in this paper could be seen as one response to Bing's challenge. It is a first year undergraduate design course based upon a study on Hong Kong's container buildings. As one of the peculiar phenomenon in Hong Kong's built environment, container buildings demonstrate a broad range of fundamental design principles in a simple and straightforward manner. Using it as a local and cultural reference in beginning training relates the students' design learning close to their daily life. The modular design method embedded in container buildings suggests a kit of parts approach. A complex design experience is achieved through the definition of three typical design problems and the design of an interwoven learning structure. A brief description will be given on the source and content of the course, followed by a discussion on pedagogic issues generated from this particular kit of parts approach.

HONG KONG'S CONTAINER ARCHITECTURE AS A TEACHING REFERENCE

As one of the busiest container ports in the world, container related activities are an integral part of Hong Kong's built environment. In Hong Kong, especially in the New Territories, containers are ubiquitous. They are seen being moved on trucks in all directions, stacked up in the harbor, on ships, and in container terminals. Empty containers are stored in huge stacks in the New Territories farmland. Their immense volumes compete on the landscape with high-rise housing estates. They also have a second existence: refurbished or custom-made containers serve as temporary buildings for construction site offices, car repairing workshops, transportation companies, hostels, and many other functions. Clearly these buildings are not "designed" by architects. Stacked and grouped, with additions of terraces, stairs, and roofs, they often form interesting complexes with surprising *design* qualities. We might recognize them as a new type of vernacular architecture. Being vernacular, they are often neglected by people because of their pure utilitarian appearance.

However, we found that a lot can be learned from these container buildings. The design principle revealed from this type of vernacular form is known as the modular approach. The basic element is the standard container unit with a few variations in dimension. A unit contains a standard space volume. Several units can merge into a larger room through juxtaposition. A unit also can be seen as a tectonic element. Through different ways of stacking and grouping, a variety of space types can be generated. They are easily assembled and removed without destroying the land, a perfect solution for temporary purposes of different functions. The flexibility of stacking and grouping allows these buildings to fit into various site conditions either in downtown areas or rural contexts. The making of these buildings involves very simple technology at rather low costs. Low technology provides straightforward design – simple structure, interesting detailing and clever climate responsive solutions.

Fig. 1. An office complex including a canteen for track drivers.

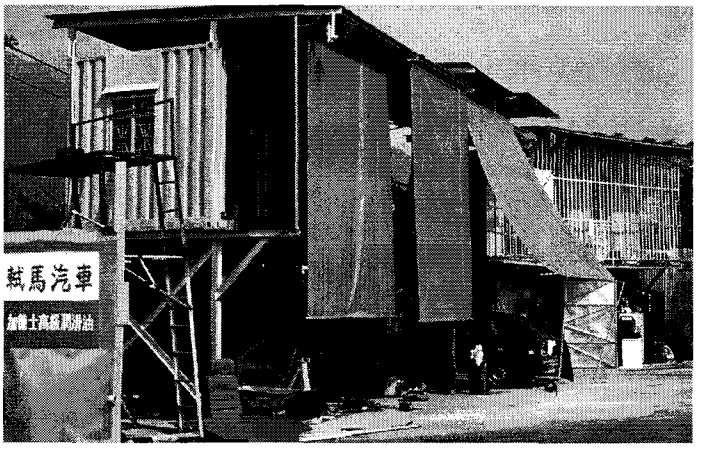

Fig. 2. A car repairing workshop with a climate responsive solution.

As teachers responsible for beginning design course, we also saw the connection between the modular design approach demonstrated in these container buildings and the kit of parts approach in introductory architectural education. We realized the potential of this local phenomenon as a rich resource for a unique first design program in this particular teaching context.

THE CONTAINER PROJECT: UNIT, SITE, AND COMPLEX

The container project started in 1994 as one of the studio projects within the first year design curriculum. In the following years, it gradually developed and expanded into a whole year studio program. The project continued until 2000. The actual content of the curriculum for each year varied as we kept clarifying the main pedagogic issues, experimenting with new exercises, and refining the structure of the curriculum. However, a set of design projects began to emerge after several years of implementation. The essential topic of the studio is about the notion of space that is explored at three distinct levels, under the title of unit, site, and complex. Each studio project contains a series of small exercises. Three projects interrelate to each other and form different phases of a coherent design curriculum. In setting up this design curriculum, we tried to achieve two objectives. First, the curriculum should provide sufficient training in graphic and model-making skills following a structured manner so that a considerable level of accomplishment can be achieved. Skills as such should not be introduced purely as a subject for itself, but as an integral part of the design process. Only in this way that students will learn these skills in context. Second, the curriculum should have a broad coverage of design issues or aspects ranging from human scale to urban context. These issues or aspects can be then picked up and further developed in the following years in greater detail and complexity. They should be introduced as a whole, in connection to each other.

The scenario for the design program is usually a temporary student hostel consisting of two dozen living units and a small gathering place, all assembled by containers on a chosen site on the campus or nearby. The project begins with the design of a living unit, living units are then organized into a site, following that is the design of a community complex. A brief description of each project or phase is given below.

Phase I: The Unit

The central theme in this phase is about the notion of space. Related issues are the perception of space, the definition of space, and the interaction between space and human scale and activities. The kit consists of the container unit (sleeve), an additional volume, and a set of furniture elements (solid blocks). The additional volume allows a limited manipulation of the initial form of the unit. The furniture elements take up space through their volume, define space through their surfaces, and act as a concrete representation of activities. Operation and skill development are controlled by a sequence of models with related drawings.

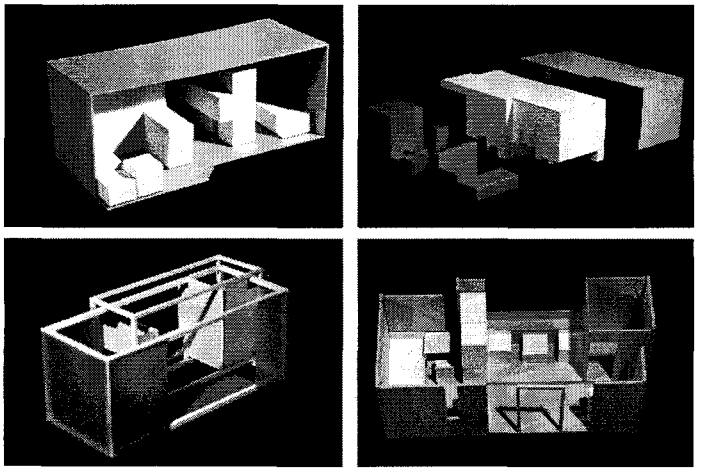

Fig. 3. 4 model studies of the unit, 1:20

1. The block model: intuitive play with parts

It is the first attempt to organize a room with given furniture blocks within a standard container volume. The task is given in such a way that students tackle the problem without much lecturing on design theory. Resulting models are true reflections of student's instinctive responses to the issue of solitude.

2. The model of solid and void: introducing the notion of space

The purpose of this exercise is to introduce the notion of space. The positive part, the furniture blocks, is represented in solid and the negative part, the void space, is represented in another solid of different material and color. These two parts can be assembled together to form a single mass contained in the sleeve. This spatial awareness is essential for students to shift from use-centered thinking to spatial thinking.

3. The conceptual model: abstraction

Its purpose is to further extract the underlying spatial concept. Through an abstract model, the initial intuitive reaction in the block model is gradually transformed into a clear design concept. Students are encouraged to use different materials or found objects to represent some abstract notions such as spatial zoning, functional hierarchy, qualities of space, etc.

4. The design model: materialization and articulation

This model is used to articulate the form. The container as an envelope is further differentiated with openings, the furniture blocks are differentiated by their planar characteristics, and the relationship between the two is further studied.

Phase II: The Site

In this phase the living unit developed by each student in the previous phase becomes the main part in a new kit which has now as many variations as the number of students. The task is to use the unit as a repetitive element to form a small community of living. A real site is chosen. The notion of space explored at this level is mainly about the organization of urban space or outdoor space. Its order can be seen as a hierarchy of organization from unit to combination, to group, and to site.

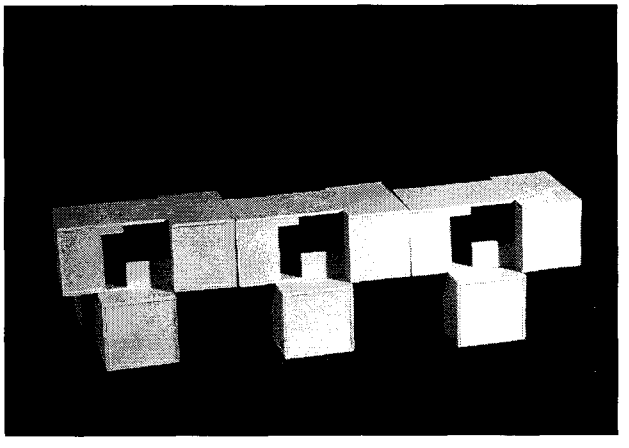

Fig. 4. Model exploration of grouping and clustering, 1:50

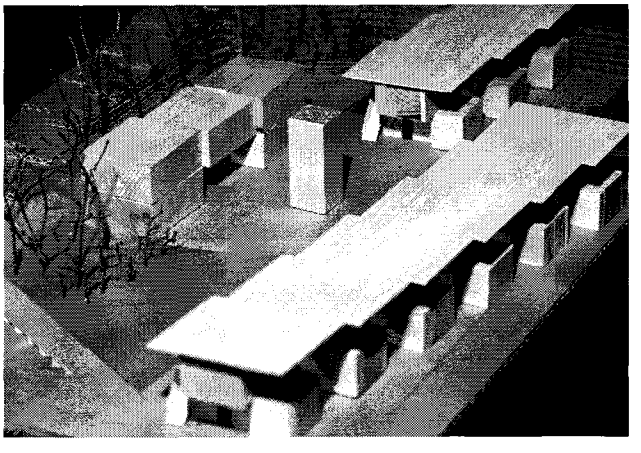

Fig. 5. The site model, 1:200

1. From unit to group and cluster

Each student now has a unique living unit as the starting point for this phase. The combination of two living units forms a duplex, and several duplexes form a group or a cluster. Students are urged to study carefully the inherent formal and functional qualities embedded in each particular living unit for design inspiration. A particular unit, with its unique volumetric configuration (as an additional volume is attached) and its inner spatial organization, suggests certain directions for grouping and clustering. Addressing this point makes students aware of the interrelationship between the previous phase and the task in hand.

2. From context to site

The formation of a site plan is not only driven by the organization of the container clusters but also inspired by the location of this community. The focus is placed on the formal and spatial context of the site. The consideration of context forces the student to adopt a complex strategy that is characterized as two interwoven lines of development. One starts from units to groups, and finally to a total structure of the site. The other is from the site to groups and units, influencing the placement of those objects. Two design techniques are introduced to help students to achieve a coherent site order. One is the figure-ground study of spatial configurations. The other is a study of spatial experience through walkthrough sketches. The latter is assisted by a video camera set installed in the studio.

Phase III: The Complex

Within the site developed in the previous phase, there is a place reserved for public gathering. Students were not informed about the content of this gathering place but were given adequate numbers of identical container units for placement. Now they have to design a community center using container units. The term "complex" implies a building consisting of different functional activities and space dimensions. The study of space at this level focuses on the complexity of a building as a unity of space, function, structure and context.

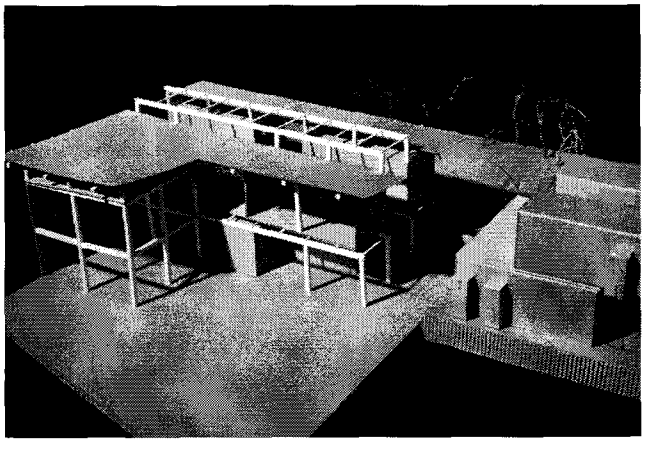

Fig. 6. The model of the complex, 1:50.

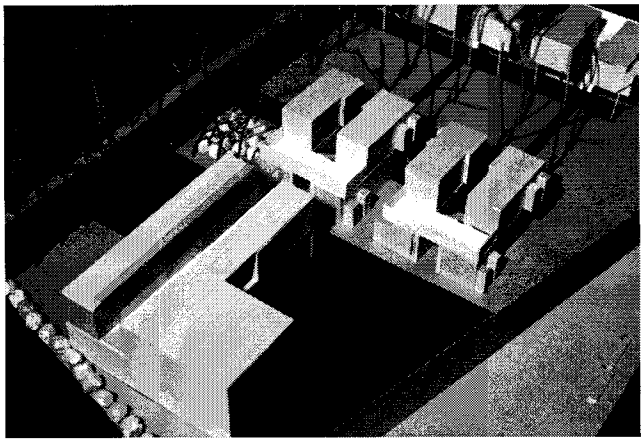

Fig. 7. The complex in the context, 1:200.

1. Container site visits

Before they start to tackle the problem, students visit several container sites around the New Territories. They study structural components of those container buildings, take measurements and produce detailed technical drawings. The visit informs the students especially about the material, construction and structural aspects of container buildings.

2. The development of the complex

The complex should provide spaces for gathering, reading, and administration. Some of these requirements can be fulfilled by a single container unit or by the juxtaposition of several units. Some have to be provided by using container units as tectonic elements, forming a larger gathering space in-between. In a series of exploratory models and clarifying drawings, issues of spatial organization, circulation and structure are introduced and gradually integrated. During the design process, students become more and more aware that the particular context the complex is placed in plays a critical role for design inspiration. Similar to the previous phase, each student actually has his/her particular site for the complex. We encourage students to react on each particular context not only functionally, but also spatially and formally.

3. The envelope

The study of envelope is the third step in this phase. This is not meant to be a pure façade design problem. It is supported by a required introductory course on environmental technology so that the envelope is mainly considered as a principle modulator between exterior and interior environment. Examples from container buildings are used to illustrate low tech strategies for environment comfort. A series of simple experiments are conducted to test the efficiency of student's design in terms of natural ventilation, solar radiation, and natural lighting. The issue of material and detail is another focus in this study. Information gained from site visits provides a basis for students to develop their own details. This study is carried out in a bigger scale model and drawings.

REFLECTIONS ON THE CONTAINER KIT OF PARTS APPROACH

The advantage of the kit of parts approach in beginning design training lies primarily in its potential for a structured and rigorous design program. However, its actual application seems limited. The abstract nature of the kit of parts approach almost prevents to achieve design complexity. The teaching experiment based upon the container kit of parts as described above demonstrates a possibility to establish a unity between these two contradictory qualities.

The container kit of parts project shows a good balance between the abstract quality of the kit of parts approach and the true nature of the container architecture. The interrelationship between the two is worth further discussion. As teaching architecture in Hong Kong, we feel strongly a need to define a local reference to which both teachers and students can constantly refer. The vernacular nature of the container architecture expresses design principles in a simple and straightforward manner. We think that this local architectural reference is appropriate and useful for introducing a wide range of design issues to the students who are a part of this environment. On the other hand, the idea of modular design embedded in the container architecture allows us to devise a series of interrelated design problems under the principle of the kit of parts approach. So that, the container architecture discovered in the region complements the abstract kit of parts exercises. The container architecture defines a training program and the program helps to reveal the extraordinary design qualities of those ordinary container sites, which gives this learning experience a special quality.

One of the most significant characteristics of this container program is its interwoven instructional structure that the three projects described before are interrelated and together form a coherent design project. Design is complex and multi-dimensional. We try to make students aware of this nature through design rather than lecturing. However, people may think that a highly structured design program as such will counteract the effort to achieve complexity. From our experience, contrary to this common view, the realization of design complexity can be achieved in a systematical way, through a careful design of the learning/designing process. As described above, each project or phase has a particular topic. Together they form a cumulative and structured process in which the first phase acts as a stimulus for the next and the latter provides new insight into the former. A structured approach allows students to focus on a specific issue each time, and to see their interrelation as a progressive, dialectic process. As we look into the actual learning/designing process, this characteristic becomes apparent. For instance, the inspiration of design ideas is embedded in the given condition as early as the first day design problem — designing a room space with a given container block and an additional volume. Required additional volume added to the identical container block makes each student's design unique and the uniqueness of design further grows into other phases as we keep stressing on the interrelationship between each phases.

In the development of this teaching approach, we also feel the limitations embedded in container unit. Its materiality (metal structure) does not provide chances for introducing ordinary building materials and structural systems, which should be the focus of introductory training. Therefore, we also consider other alternatives for local and cultural references. For the concept of modular design, Chinese vernacular villages and houses might be another opportunity for a teaching experiment on the kit of parts approach.

REFERENCES

[1]Bing, Judith, "Beyond the Kit of Parts: An Integrated Approach to Beginning Design in Architecture," *ACSA International Conference*, 1993.

[2]Friedman, Jonathan Block, *Creation in Space: A Course in the Fundamentals of Architecture*. Kendall/Hunt Publishing Company, 1989.

[3]Jansen, Jürg (etc.), *Teaching Architecture: Bernhard Hoesli at the Department of Architecture at the ETH-Zurich*, ETH-Zurich, Institut fuer Geschichte und Theorie der Architektur, 1989.

[4]Caragonne, A. *Notes on the Texas Rangers - A Short History of A Teaching Program at the University of Texas School of Architecture 1953-1958*, MIT, 1995.

[5]Bertin, Vito; Gorer, Peter; Daqing, Gu; Woo, Leng. "The Vernacular Contained," Spazio, (1997): July-September.

(This paper is supported by the United Board for Christian Higher Education in Asia Faculty Research Grant from the Chung Chi College, The Chinese University of Hong Kong.)