Summary

de l'assemblage l'une est totalement contenue dans l'autre ou si les deux sont totalement séparées.«
La convergence est importante pour effectuer la distinction entre le demi-assemblage et l'arbre. Plus important encore est le fait que le graphe anti-symmetrique est potentiellement une structure beaucoup plus complexe que l'arbre. A ce sujet, voici un exemple éloquent: un arbre, formé de 20 éléments, pourrait contenir au maximum 19 autres quantités partielles de ces 20 éléments. En revanche, un demi-assemblage à la base de ces 20 éléments pourrait contenir plus d'un million de différentes quantités partielles. Cette multiplicité considérable est le signe de la grande complexité structurale que possède un graphe anti-symmetrique, contrairement à la simplicité structurale d'un arbre. Le manque de complexité structurale qui est la caractéristique des arbres paralyse notre vision de la ville.

Villes artificielles qui sont des arbres

Considérons quelques conceptions modernes de la ville pour démontrer qu'elle représente, dans ses parties primordiales, l'image d'un arbre:

Fig. 1: Columbia, Maryland/Community Research and Developement Inc.:
Des pâtes rapprochés de maisons, par groupes de 5, forment des «villages». Un réseau de circulation rattache les villages à un nouveau centre urbain. L'organisation est celle d'un arbre!

Fig. 2: Greenbelt, Maryland/Clarence Stein.
Cette ville-jardin a été divisée en superblocs. Chacun de ces derniers contient des écoles, des parcs et un certain nombre de groupes de maisons construites autour des parkings. L'organisation est un arbre.

Fig. 3: Greater London Plan (1943 / Abercrombie et Forshaw.
Le dessin indique la structur prévue pour Londres, structure mise au point par Abercrombie. Il y a ici un nombre considérable de «communes» où chacune est visiblement séparée de l'autre. La ville est prévue comme arbre avec deux superficies principales. Les communes sont les plus grandes unités de la structure.

Fig. 4: Plan de Tokyo/Kenzo Tange
Voici un exemple particulièrement éloquent. Le plan consiste en une série d'anneaux qui s'étendent au-dessus de la baie de Tokyo. Il y a quatre anneaux principaux dont chacun contient trois anneaux moyens. Au deuxième anneau principal, un anneau moyen renferme la gare, un autre le port. En outre, chacun des anneaux moyens possède trois anneaux inférieurs qui abritent des quartiers d'habitation.

Fig. 5: Mesa City/Paolo Soleri
A première vue, les formes organiques nous paraissent moins raides que dans les exemples précédents. Mais à l'examen, nous retrouvons le même principe d'organisation. Regardons le centre universitaire! Ici, le centre de la ville est divisé en une université et en une zone d'habitation. Cette dernière est de nouveau divisée en un certain nombre de «villages» (en réalité, il s'agit de tours d'appartements) abritant 4 mille habitants. Chaque village est à nouveau divisé et entouré de groupes d'unités d'habitation toujours plus petites.

Fig. 6: Chandigarh (1951) / Le Corbusier
L'ensemble de la ville est alimenté par un centre commercial situé au milieu et qui est relié au centre administratif situé à la périphérie. Deux zones commerciales supplémentaires s'étendent le long des routes principales, en direction nord-sud. En plus, il existe d'autres centres commerciaux et administratifs, correspondant à chacun des 20 secteurs de la ville.

Fig. 7: Brasilia / Lucio Costa
Toute l'installation est symétrique par rapport à l'axe central. Chacune des deux moitiés est alimentée par une seule artère de circulation principale. Cette dernière est elle-même alimentée par des artères secondaires parallèles. Enfin, il y a des rues entourant les superblocs qui aboutissent dans les artères. Le structure est un arbre.

Fig. 8: Communitas / Percival et Paul Goodman.
Communitas est exactement construit comme un arbre. Tout d'abord, elle est divisée en quatre ceintures principales. Celle de l'intérieur est un centre commercial, la suivante une université, la 3ème renferme des appartements et des cliniques et la quatrième est un paysage ouvert.
A l'intérieur de chacune, il y a encore d'autres divisions. Toute l'organisation est un arbre.

Fig. 9: Celui-ci est le meilleur exemple car il cerne parfaitement le problème. Il a été publié dans l'ouvrage «La nature des villes«, de Hilbersheimer qui décrit le fait que certaines cités romaines ont leur origine dans des camps militaires. Ensuite, il présente l'image d'un camp militaire moderne comme étant une sorte d'archétype de la ville moderne.

Toutes ces structures étaient des arbres. Les unités qui forment une ville artificielle sont toujours organisées à l'image de l'arbre. La définition de l'arbre est donc la suivante: Une structure d'arbre signifie qu'à l'intérieur de cette structure aucune partie d'une unité quelconque n'est liée à d'autres parties si ce n'est à l'unité comme un tout.

Une ville vivante doit être un graphe antisymmetrique.
Examinons maintenant les villes naturelles qui se présentent comme graphe antisymmetriqus. Par exemple, la ville naturelle de Middlesborough correspond à la structure d'un graphe anti-symmetrique, tandis que dans la conception artificielle de la ville, les convergences naturelles et caractéristiques sont modifiées.
La séparation totale des lieux d'habitation et de travail n'est pas un principe idéal et pourtant on le trouve dans chaque ville artificielle. Les zones doivent converger pour rendre la ville vivante et saine. Il en est de même avec la division de la ville en «communes» isolées. Le plan d'Abercrombie pour Londres, par exemple, est une structure d'arbre. Cependant, les communes isolées ne correspondent pas à la réalité. Dans la capitale britannique, comme dans toute autre grande ville, personne ne trouve du travail à proximité de son lieu d'habitation. Ainsi, les habitants d'une commune travaillent dans des fabriques situées dans d'autres zones. C'est pourquoi les systèmes «lieu de travail – habitation» doivent être convergents et les unités doivent former un graphe antisymmetrique.

L'origine de penser en forme d'arbre:

Bien que l'arbre offre une voie simple et claire pour diviser un tout complexe en unités, il ne représente pas correctement la véritable structure de la ville vivante, pas plus d'ailleurs que la structure des villes dont nous avons besoin. On se demande alors pourquoi tant d'urbanistes ont conçu des villes en arbres alors que la structure naturelle est dans le graphe antisymmetrique! Ils l'ont fait, vraisemblablement, parce qu'ils ne peuvent pas atteindre la complexité d'un graphe antisymmetrique par un procédé de réflexion. L'esprit ne peut pas saisir aisément cette complexité à cause des convergences multiples du graphe antisymmetrique. Les urbanistes sont constamment confrontés à ce problème. L'arbre est compréhensible et facile à manipuler. Le graphe antisymmetrique est difficilement saisissable pour l'esprit, on ne le manie donc pas aisément.
Toutes les expériences indiquent que les hommes, lorsqu'ils sont confrontés à une organisation trop complexe, essaient de la réorganiser spirituellement en membres d'unités non-convergentes. complexité du graphe anti-symmetrique fait place à la simplicité de la forme de l'arbre. Des études se poursuivent dans le dessein de discerner et de préciser les convergences requises par la ville moderne. On tente aussi de transformer ces convergences adéquates en conditions physiques et plastiques. Car la ville n'est pas et ne doit pas être un arbre. Si nous construisons des cités à l'image de l'arbre, notre vie sera morcelée de manière inadmissible.

Summary

Kiyonori Kikutake, Japan

(Pages 256–282)

Visons 1960

Tower Shape Community (1959)
The problems raised by the planning of Tokyo appear to be inextricable and insoluble. This agglomeration of ten million inhabitants extends horizontally since the average height of its buildings is 1.3 floors. Kikutake does not present a complete solution of the problem, but his proposal contains a possibility of imposing shape on the complex of the city by opposing to the horizontal city the other extreme of the vertical city, by replacing the traditional relations of the individual with the earth by a relation of the entire community with the soil. In the future city the place of residence will be fixed on artificial ground, on a tower trunk. The tower is to be the monument of modern life, the symbol of living in the urban community. This "terrestrial surface" in the shape of a partition wall contains the service network, i.e., water, gas, electricity, sewerage, as well as the vertical communications system. The tower will accommodate around 5 thousand persons in 1250 residence units. It will attain a height of 300 meters. The cylindrical trunk will be constructed according to the principle of exterior growth and interior regeneration.

2) Oceanic Civilization (1959)
"Marine City" proposes to mankind the realization of his world of the future. The earth is not growing in size, but the population of the earth is increasing constantly. The purpose of "Marine City" is not to create new ground or to exile man from the soil, but simply to modify the ancient relations between man and the soil. When a unit of the ocean city no longer satisfies its users, it will be taken out to sea and sunk. "Marine City" has no definite location. It can be taken wherever man desires to have it . . . A main floating body will produce all the parts needed. The production facilities will be below sea level, while the residential zones will be above the surface of the water. The sea, which constitutes 70% of the surface of the globe, will be man's new environment.

3) Unabara 1960
The ocean city of Unabara is a floating industrial city of 500,000 inhabitants. Located in Sagami Bay, near Tokyo, Unabara will be the central part of the Japanese industrial belt along the Pacific coast. The big cities will spread out towards the sea and will be progressively detached from the coast. This is why Unabara will not remain at one fixed location but will be moved to the places where it is required. In its final stage, Unabara will be made up of two concentric rings, the exterior ring for production and the interior one for residence. The two rings will meet at one point: the administration centre consisting of a control tower. Unabara will grow as long as the control tower can survey the whole extent of the city. If the city becomes too large, the erection of a new control tower will be decided on, which will be at the same time the point of departure of the next island.
On the residence ring there will be erected MOVA blocks composed of a mast and three "sails". A mast 100 meters high will accommodate 10,000 persons in its sails. The MOVA block rests on a concrete ship. Six of its units constitute a large unit which, along with six others, constitute a whole city equipped with parks on the interior. The city accommodates universities, convention halls, museums, etc. on the surface of the "ship". A block has a life span of 50 to 100 years, after which it will be replaced.

Vision of a new society

With the advent of oceanic civilization there is a chance of modifying the relations of man with the earth. The relation of the individual with the soil will be replaced by the relation of the total community with the earth. This will be a civilization without any tradition, a veritable liberation from the surface of the earth and from the human desire to possess, constantly, material objects. However, this type of civilization will create a new relation among men and also between the individual and his environment in the sense that "the whole community will work for the welfare of the individual".

Civilization, communications network

In this extremely artificial civilization, the individual will no longer be able to orient himself with the aid of his instincts alone. In a system that is at once highly articulated and fragile, the security provided by the instincts will be replaced by systems of information and communication. The central control tower stands guard over the organization, the construction and the maintenance of the civilization; circulation ducts serve to interconnect the various elements and units; complicated installations are available to users, while a mobile mechanism is employed to alter the orientation, the situation of the residence units. This is a perfect technocracy, a sphere in which all mechanisms and communications are totally regulated.

Biological analogy

Here is another typical feature of Unabara: it is an artificial system of production with exterior growth and interior regeneration, which constantly replaces elements rendered out of date by new improved elements. This is made possible by the conception of an environing zone made up of units that are independent, limited, well defined and detachable.

Theory

Kiyonori Kikutake

Research into human values

In our century, science has brought about profound changes. Moreover, mankind is becoming more and more conscious of the necessity of drawing up plans, in all fields, while taking into consideration human values at the same time. We are obliged to reflect if we are to determine the lines of the new architecture demanded by the new reality in which we live. For this purpose our greatest task is the elaboration of methods.

Shape and system – Katachi and Kata

Shape – KATACHI – becomes apparent in every plan. There is no plan without a given shape, there is no plan which is inaccessible to the senses. Katachi is the fruit of architecture, as it were. To understand architecture means, then, to look for Katachi from the outset.
Let us examine Katachi as it appears in Japanese architecture: The most famous example of traditional architexture is the Ise Shrine and the Katsura Villa. The term KATA, or system, is employed to designate the basic principle behind KATACHI. If a KATACHI is treated solely as a shape, it becomes lifeless formalism. Only the basic KATA, with its powerful and decisive influence, is the proper point of departure af a KATACHI. The fundamental task of modern architecture is to discover a KATA which permits the free expression of individuality.

A three-step procedure

In raising the question "what is the nature of KATA?", Kikutake arrives at a conception procedure comprising three steps. This conception takes as its point of departure the stages in which phenomena are perceived, moves towards substances and finally reaches the level of actual nature. This procedure is not only utilizable because it is theoretically correct, but

because nature itself is also based on a similar structure. The three steps in this procedure are as follows:
1st step
KATACHI: shape, morphological plan
2nd step
KATA: type, substantial plan
3rd step
KA: image, natural plan

Realizations

Kiyonori Kikutake

The "Sky House"

In the case of the Sky House plan, there has been taken as the point of departure the contradictions existing at the present time in the construction of housing. The Sky House is supposed to correspond to the transformations in the social structure and in family standards of living.

Competition for the International Conference Palace in Kyoto

The successful competitors in this competition which was held in 1963 were S. Otani (1st Prize), M. Otaka (2nd Prize), K. Kikutake (also 2nd Prize) and others. In order to present the characteristic features of these plans, we are contrasting Otaka's and Otani's projects with those of Kikutake.

In the case of Otaka, we find the typical signs of a functional architecture in the most classical sense of the word. The conception of a specific shape, a specific design, is reflected in the groups of principal functions in the great hall, the small hall and the office building on several levels connected with supplementary premises by means of a 2-storey foyer. Otani's and Kikutake's plans are based on a different conception method. Instead of developing specific shapes for specific functions, they attempt to obtain a building that is closed in and that integrates various needs via a general principle: Otani employs the principle of continual production in specific rooms and Kikutake that of hierarchic order.

Hotel Tokoen, Kaike Spa. Yonago. Tottori Prefecture, 1963–64

The new building was incorporated in the centre of an old Ryokan (Japanese hotel) whose rooms were grouped, in the traditional manner, around small courtyards and a central garden. The hotel is situated on the coast of the Sea of Japan. It commands a splendid view over the coast and a mountain. Contrary to the principle of the ancient Ryokan, whose rooms were disposed around gardens, Kikutake creates a contrast by greatly elevating the residence floors and the neighbouring structures in order to get a panoramic view. The public rooms, the bedrooms and the restaurant on the roof were grouped vertically in accordance with their functions.

Hotel Pacific. Chigasaki City. Kanagawa Prefecture, 1965–66

This hotel was constructed near Tokyo, on the Pacific coast. Its complex program contains, in addition to bedrooms, two swimming pools, an indoor pool and an outdoor one, a bowling alley, restaurants, bars and a drive-in restaurant. As in the Hotel Tokoen, we find here an apparent differentiation between the serving and the served elements. The two hotels in fact both have the same distribution of functions: there are first the public rooms and, above them, the private zone. However, in the Hotel Pacific, the bedrooms are grouped spirally in a tower.

Publications

Generous extracts from the complete works of Kiyonori Kikutake have been published in the review "Kenchiku", in November 1961, September 1963, April and October 1965 and July 1966. The periodical "Kokusai Kenchiku", in January 1959, published "Tower Shape City", in February 1959 "Marine City", and in April 1966 there appeared in "Shinkenchiku" an article entitled "Pear City".
The work entitled "Metabolism 1960" was put out by Bijutsu Shuppan in Tokyo.
Guenter Nitschke published an article on the Metabolists in Building+Home, No. 5, 1965 and in the review Architectural Design, October 1964. He deals, in detail, with the theory and the plans of the metabolists against the background of the gigantic urban chaos of Tokyo.
"Sky House" has been presented in Building+Home

Biography of Kiyonori Kikutake

He was born in Kurume, Japan, on April 1, 1928. In 1950 he completed his architectural studies, graduating from Waseda University in Tokyo. In 1953 he created the architecture office "Kikutake Architect & Associates".
In 1959–60, during the preliminary work for the World Design Conference in Tokyo, a group of young architects prepared its suggestions and visionary projects regarding a new organization of the city of Tokyo. At the time of the World Design Conference, their group was formally established and their publication entitled "Metabolism 1960" came out, its full title being "Metabolism 1960, proposal of a new type of town-planning".
Since 1960, the members of the "Metabolism 1960, group have been meeting regularly. This year again, they will bring out a second volume "Metabolism 1965. Towards the metapolis".
In 1964, Kikutake received the "Pan Pacific Architecture" prize of the Institute of American Architects in Hawaii as well as 2 prizes for the administration building at the Izumo Shrine. In 1965, he received a prize for the Hotel Tokoen from the "Building Contractors Society".
Kikutake is a member of the Association of Japanese Architects as well as of the Town-Planning Committee of the Institute of Architecture of Japan.

Christopher Alexander, Berkeley

A City is not a Tree

(Pages 283–290)

The tree of my title is not a tree with green leaves. It is the name of an abstract structure. It will be contrasted to another more complicated complex which is called "semi-lattice". A city is a semi-lattice and not a tree.

Natural cities and artificial cities

I designate natural cities those which have grown more or less spontaneously over a long period, while artificial cities have been constructed by town-planners. Siena, Liverpool, Kyoto and Manhattan are examples of natural cities, and Levittown, Chandigarh and the British New Towns are typical artificial cities.
It is generally admitted nowadays that our modern attempts to create artificial cities have not been successful What they all lack is something absolutely essential: the human side. Our problem now is to rediscover what it is, in the old cities, that gives life and creates atmosphere, so that we can incorporate these characteristics in our own artificial cities. The natural city is the formation of a semi-lattice, whereas when we organize an artificial city, it becomes a tree.

Trees and semi-lattice

The tree as well as the semi-lattice constitute means of formation of a large set by way of numerous small systems which thus become a large complex system. In general, the two designate set structures. A mass, in the sense employed here, is an set of elements which, for certain reasons, we consider as the total complex. If the elements of a set cooperate or work together, we call the set of elements "system". If the structure fills certain conditions, it is a semi-lattice. It is called "tree" when it meets other limited conditions.
Here is the axiom of the semi-lattice: "An set of elements constitutes a semi-lattice when two convergent sets form part of the system and when the same number of elements of these two sets are found in the system".
And here is the axiom of the tree:
"An set of elements forms a tree if, of any 2 sets of the system, one is entirely contained in the other or if the two are completely separated".
The convergence is important for effecting a distinction between the semi-lattice and the tree. Still more important is the fact that the semi-lattice is potentially a much more compelx structure than the tree. On this point, here is a very revealing example: a tree, made up of 20 elements, could complexity possessed by a semi-lathand, a semi-lattice based on these 20 elements could contain more than a million different partial quantities.
This considerable multiplicity is the sign of the high degree of structural contain up to 19 other partial quantities of these 20 elements. On the other tice, contrary to the structural simplicity of a tree. The lack of structural complexity which is the characteristic of trees paralyzes our vision of a city.

Artificial cities which are trees

Let us consider a few modern conceptions of the city in order to show that it represents, in its basic constituents, the image of a tree:

Fig. 1: Columbia, Maryland / Community Research and Development Inc.
Dense blocks of houses, in groups of 5, constitute "villages". A traffic network connects the villages with a new urban centre. The organization is that of a tree!

Fig. 2: Greenbelt, Maryland / Clarence Stein.
This garden-city has been divided into super-blocks. Each of these contains schools, parks and a certain number of groups of houses constructed around parking sites. The organization is a tree.

Fig. 3: Greater London Plan (1943) / Abercrombie and Forshaw.
The drawing indicates the structure envisaged for London, a structure perfected by Abercrombie. There are here a considerable number of "neighbourhoods", each one being visibly separated from the next. The city is planned as a tree with two principal surfaces. The neighbourhoods are the largest units in the structure.

Fig. 4: Plan of Tokyo / Kenzo Tange.
Here is a particularly eloquent example. The plan consists of a series of rings which extend above Tokyo Bay. There are four principal rings, each one of which contains three medium-size rings. In the second principal ring, a medium ring encloses the railway station and another the harbour. Moreover, each of the medium rings possesses three smaller rings accommodating the residential areas.

Fig. 5: Mesa City / Paolo Soleri.
At first sight, the organic shapes seem less rigid than in the preceding examples. However, on closer examination, we encounter the same organizational principle. Just consider the university city! Here the centre of the city is divided into a university and a residential zone. The latter is again divided into a certain number of "villages" (in reality, there are involved in this case apartment towers) housing 4 thousand residents. Each village is again divided up and surrounded by still smaller groups of residence units.

Fig. 6: Chandigarh (1951) / Le Corbusier.
The total complex of the city is serviced by a business centre located in the centre and connected with the administrative centre situated on the periphery. Two supplementary commercial zones extend along the main traffic arteries, in the north-south axis. Moreover, there are other commercial and government centres corresponding to each of the 20 sectors of the city.

Fig. 7: Brasilia / Lucio Costa.
The entire installation is symmetrical in relation to the central axis. Each of the two halves is serviced by one single main traffic artery. The latter is in turn serviced by parallel secondary arteries. Finally, there are streets surrounding the super-blocks which lead into the main arteries. The structure is a tree.

Fig. 8: Communitas / Percival and Paul Goodman.
Communitas is constructed exactly like a tree. First of all, it is divided into four principal belts. The inner one is a business centre, the next a university city, the third accommodates apartments and hospitals and the fourth is open country. In the inside of each there are still other divisions. The entire organization is a tree.

Fig. 9: This is the best example, for it perfectly circumscribes the whole problem. It has been published in the work entitled "On the nature of cities" by Hilbersheimer, who points out the fact that certain Roman cities originated in military camps. Then, he presents a modern military camp as being a kind of archetype of the modern city.
All of these structures were trees, in the sense employed here. The units which make up an artificial city are all organized in the image of a tree. Therefore the tree, in this sense, can be defined as follows: A tree structure means that on the inside of this structure no part of any unit is connected with other parts unless it is connected with the unit as a whole.

A living city ought to be a semi-lattice.

Let us now examine the natural cities which appear as demi-assemblages. For example, the natural city of Middlesborough corresponds to the structure of the semi-lattice, whereas in the artificial conception of the city, the natural and characteristic convergences are modified.
The total separation of places of residence and places of work is not an ideal principle; nevertheless, it is a feature of every artificial city. The zones ought to converge in order to make the city vital and viable. The same thing applies to the division of the city into "neighbourhoods" isolated one from the other. Abercrombie's plan for London, for instance, is a tree structure. However, these isolated neighbourhoods correspond to nothing in reality. In the British capital, as in every other large city, no one finds work close to his place of residence. Thus, the residents of one neighbourhood unit work in factories located in other zones. That is why the "place of work – place of residence" systems ought to be convergent and the units ought to form a semi-lattice.

The origin of the "tree" concept

Although the tree offers a clear and simple way of dividing a whole complex into units, it does not correctly represent the real structure of the living city, any more than it does of the cities we need. The question arises, then, why so many town-planners have designed cities as tree structures, whereas the natural structure is the semi-lattice! They have proceeded in this way, probably, because they are unable to approach the complexity of a semi-lattice by way of a process of intellectual reflection. The mind cannot easily grasp this complexity because of the multiple convergences of the semi-lattice. The town-planners are constantly confronted by this problem. The tree is comprehensible and easy to manipulate. The semi-lattice is difficult for the mind to grasp, and it cannot be manipulated so easily.
All experience indicates that men, when they are confronted by an excessively complex organization, attempt to reorganize it mentally into non-convergent units. The complexity of the semi-lattice gives way to the simplicity of the tree shape. Studies are now being conducted to discern and to define the convergences required by the modern city. An attempt is also being made to transform these adequate convergences into physical and plastic conditions, for the city is not and ought not to be a tree structure. If we build cities in the image of a tree, our life will be compartmentalized in a wholly unwarrantable manner.