CHRISTOPHER ALEXANDER

A CITY IS NOT A TREE: 50TH ANNIVERSARY EDITION

WITH

MIKE BATTY * LUÍS BETTENCOURT * HOWARD DAVIS
JAAP DAWSON * BIN JIANG * MICHAEL W MEHAFFY
HANS JOACHIM NEIS * DELLÉ ODELEYE * SERGIO
PORTA * YODAN ROFÈ * MARIAPIA VIDOLI

AND OTHER CONTRIBUTORS

EDITED BY

MICHAEL W MEHAFFY

SUSTASIS PRESS
IN ASSOCIATION WITH
CENTER FOR ENVIRONMENTAL STRUCTURE

ISBN: 978-0-9893469-7-9 (USA edition printed in Amherst MA)
ISBN: 978-9-4638648-1-7 (Europe edition printed in Rotterdam NL)

Sustasis Foundation, Portland, Oregon USA

Table of Contents

Editor's Preface

Michael W Mehaffy

“A City is Not a Tree” was first published in two parts in the American journal *Architectural Forum*, in April and May 1965. Later that year it won the prestigious Kauffman International Design Award, and the jurors noted that "the principles [Alexander] describes, and the analytical methods he adopts, are applicable at all levels of design". The paper was subsequently re-published in over a dozen journals and books, and later circulated endlessly on the Internet – but unfortunately, in formats of uneven quality and accessibility.

This seminal work has not, however, appeared in its own dedicated volume, a format where it might be studied and assessed more thoughtfully, by students, researchers, and practitioners. Given its seminal influence within the history of 20^{th} Century design theory, my colleagues and I – part of a research coordination network called the Environmental Structure Research Network (ESRG) – felt that the occasion of the fiftieth anniversary of its first publication would be an appropriate time to meet that need. We present the original paper here along with a collection of newer reflections, exegeses and critical analyses by a number of leading scholars and practitioners.

The historical influence of this slight 7,500 word paper is difficult to overstate. Its author, Christopher Alexander, has some 15 books to his credit, many of them noted theoretical or philosophical works, and several that are landmarks in their own right – among them *Notes on the Synthesis of Form* and *A Pattern Language*. But “A City is Not a Tree” has been arguably as influential for many in the field of environmental design, and indeed in design more generally, as any of his books.

A representative example may be Robert Campbell, a prominent architecture critic for the Boston Globe, who said that Alexander had “an enormous critical influence on my life and work, and I think that’s true of a whole generation of people” – and he singled out “A City is Not a Tree” as most influential for him.

Campbell recalled discovering the paper as a student in the library of Harvard’s Graduate School of Design. “That was a *landmark* moment in my development as a thinker and as an architect,” he said, speaking at the National Building Museum in 2009. “It really blew away what were the foundational principles of the education at Harvard in those days, and it established in me an interest in actually *looking* at the world – not looking at set of preconceived abstract mechanical ideas that were supposed to *replace* the existing world.”

It is instructive that such a change of focus should be necessary – that a profession bewitched by its own abstractions should need to have its spell broken, as it were, by the blunt force of a clear and compelling argument. It may also be instructive that it took so long for such an argument even to appear. That it was Alexander who did so might be explained by his work at Harvard and MIT, not only in their design schools but perhaps more importantly (as he himself has said) in their psychology departments, where he worked with legendary pioneers of cognition like George A. Miller.

Much has been said about the mathematical argument that Alexander makes, the one derived from set theory, with a close relation to network theory. This subject was later to blossom within the field of complexity science, with contributions to urban studies (including the development of Space Syntax, as our co-contributor Bill Hillier notes). Perhaps more should be noted about Alexander’s description, later in the paper, of cognitive biases and distortions, and the tendency of human minds to organize things in particular ways that are subtle but enormously consequential. In that sense, Alexander may have been an early contributor to the psychology of bounded rationality and cognitive bias, and their sometimes profound impacts on human life and social organization. If this is true, then perhaps the modern professions of environmental design are, while not the only examples of such cognitive distortions, then perhaps, “Exhibit A” in the case for reform.

The accompanying essays by contemporary authors assess the paper, its legacy, and its relevance to contemporary challenges. They do not, as a rule, attack the paper, or its author, by presenting critical dismissals or revisionist history, or even detailed critiques of technical aspects of Alexander's argument.

There are two reasons why we have refrained from including such critical texts. One is that the reader can find quite a few of them elsewhere; indeed, Alexander is a popular target in some quarters, including many corners of architectural academia. The other is that, speaking quite frankly, we believe the time has come to look for the forest and not the trees. The latter may be a fond habit – but it may also be a major reason that architectural academia is in crisis, while its relevance is challenged as never before.

At present, the world is urbanizing at an unprecedented rate: on track to produce more urban fabric in the first third of the Twenty-first Century than in *all of human history.* In that light, whatever else we may say about the strengths and weaknesses of this historic paper, we will say this: the insightful connections it developed could not be more relevant and even urgent, forming a provocative and compelling argument for reform today. In one way or another, most of the essays by the other contributors revolve around the question of what we have learned in the half-century since publication – and perhaps, in too many cases, what we still have to learn.

Acknowledgements

First and foremost, we at Sustasis Press are greatly indebted to Christopher Alexander for writing the original paper included herein, and to him and his wife Maggie Alexander for graciously supporting this project, and giving their permission for the paper to be re-published. We are also indebted to Chris and Maggie for supporting the creation of the Environmental Structure Research Network (ESRG), a number of whose members contributed to this volume.

Secondly, we are greatly indebted to those eminent co-authors who have contributed their own thoughtful exegeses on this text, investing considerable time and effort in this project. They have provided an invaluable mix of perspectives from the half-century since publication.

Thanks to my colleague Nikos Salingaros, who gave his time, assistance and ideas to this and other related projects of Sustasis Press.

Thanks to my assistant (and daughter) Leslie Mehaffy for proofreading and editing. Thanks to Levellers Press in Amherst, and 24bookprint in Rotterdam, for printing and fulfillment. Thanks especially to Yulia Kryazhneva of Yulia Ink in Amsterdam for cover design, copy-setting and formatting.

Thanks to fellow board members of Sustasis Foundation, Ward Cunningham and Bernard Franceschi, for supporting this project with their ideas and suggestions, and with their own generous funds.

Thanks also to other donors to Sustasis Foundation in support of this project and related initiatives, notably Besim Hakim of Albuquerque, Susan and Fred Ingham of Seattle, and others. We are most grateful to all supporters, past and future, who make this work possible.

- Michael Mehaffy, Sustasis Press

I THE ORIGINAL 1965 TEXT

Helgesens gate
Deli de Luca
Deli de Luca
MINIBANK
DØGNÅPENT
VIDEO
Victory

Chapter 1

A City is Not a Tree

Christopher Alexander

The tree of my title is not a green tree with leaves. It is the name of an abstract structure. I shall contrast it with another, more complex abstract structure called a semilattice. In order to relate these abstract structures to the nature of the city, I must first make a simple distinction.

I want to call those cities which have arisen more or less spontaneously over many, many years natural cities. And I shall call those cities and parts of cities which have been deliberately created by designers and planners artificial cities. Siena, Liverpool, Kyoto, Manhattan are examples of natural cities. Levittown, Chandigarh and the British New Towns are examples of artificial cities.

It is more and more widely recognized today that there is some essential ingredient missing from artificial cities. When compared with ancient cities that have acquired the patina of life, our modern attempts to create cities artificially are, from a human point of view, entirely unsuccessful.

Architects themselves admit more and more freely that they really like living in old buildings more than new ones. The non-art-loving public at large, instead of being grateful to architects for what they do, regards the onset of modern buildings and modern cities everywhere as an inevitable, rather sad piece of the larger fact that the world is going to the dogs.

It is much too easy to say that these opinions represent only people's unwillingness to forget the past, and their determination to be traditional. For myself, I trust this conservatism. People are usually willing to move with the times. Their growing reluctance to accept the modern city evidently expresses a longing for some real thing, something which for the moment escapes our grasp.

The prospect that we may be turning the world into a place peopled only by little glass and concrete boxes has alarmed many architects, too. To combat the glass box future, many valiant protests and designs have been put forward, all hoping to recreate in modern form the various characteristics of the natural city which seem to give it life. But so far these designs have only remade the old. They have not been able to create the new.

“Outrage,” the *Architectural Review's* campaign against the way in which new construction and telegraph poles are wrecking the English town, based its remedies, essentially, on the idea that the spatial sequence of buildings and open spaces must be controlled if scale is to be preserved - an idea that really derives from Camillo Sitte's book about ancient squares and piazzas.

Another kind of remedy, in protest against the monotony of Levittown, tries to recapture the richness of shape found in the houses of a natural old town. Llewelyn Davies' village at Rushbrooke in England is an example - each cottage is slightly different from its neighbour, the roofs jut in and out at picturesque angles, the shapes are 'interesting' and cute.

A third suggested remedy is to get high density back into the city. The seems to be that if the whole metropolis could only be like Grand Central Station, with lots and lots of layers and tunnels all over the place, and enough people milling around in them, maybe it would be human again. The artificial urbanity of Victor Gruen's schemes and of the LCC's scheme for Hook New Town, both betray this thought at work.

Another very brilliant critic of the deadness which is everywhere is Jane Jacobs. Her criticisms are excellent. But when you read her concrete proposals for what we should do instead, you get the idea that she wants the great modern city to be a sort of mixture between Greenwich Village and some Italian hill town, full of short blocks and people sitting in the street.

The problem these designers have tried to face is real. It is vital that we discover the property of old towns which gave them life, and get it back into our own artificial cities. But we cannot do this merely by remaking

English villages, Italian piazzas and Grand Central Stations. Too many designers today seem to be yearning for the physical and plastic characteristics of the past, instead of searching for the abstract ordering principle which the towns of the past happened to have, and which our modern conceptions of the city have not yet found. These designers fail to put new life into the city, because they merely imitate the appearance of the old, its concrete substance: they fail to unearth its inner nature.

What is the inner nature, the ordering principle, which distinguishes the artificial city from the natural city? You will have guessed from the first paragraph what I believe this ordering principle to be. I believe that a natural city has the organisation of a semilattice; but that when we organise a city artificially, we organise it as a tree.

Trees and semilattices

Both the tree and the semilattice are ways of thinking about how a large collection of many small systems goes to make up a large and complex system. More generally, they are both names for structures of sets.

In order to define such structures, let me first define the concept of a set. A set is a collection of elements which for some reason we think of as belonging together. Since, as designers, we are concerned with the physical living city and its physical backbone, we must naturally restrict ourselves to considering sets which are collections of material elements such as people, blades of grass, cars, molecules, houses, gardens, water pipes, the water molecules in them etc.

When the elements of a set belong together because they co-operate or work together somehow, we call the set of elements a system.

Here is an example (photo below). In Berkeley at the corner of Hearst and Euclid, there is a drugstore, and outside the drugstore a traffic light. In the entrance to the drugstore there is a newsrack where the day's papers are displayed. When the light is red, people who are waiting to cross the street stand idly by the light; and since they have nothing to do, they look at the papers displayed on the newsrack which they can see from where they stand. Some of them just read the headlines, others actually buy a paper while they wait.

The corner of Hearst and Euclid as it appeared in 2015. Photo courtesy Google.

This effect makes the newsrack and the traffic light interactive; the newsrack, the newspapers on it, the money going from people's pockets to the dime slot, the people who stop at the light and read papers, the traffic light, the electric impulses which make the lights change, and the sidewalk which the people stand on form a system - they all work together

From the designer's point of view, the physically unchanging part of this system is of special interest. The newsrack, the traffic light and the pavement between them, related as they are, form the fixed part of the system. It is the unchanging receptacle in which the changing parts of the system – people, newspapers, money and electrical impulses - can work together. I define this fixed part as a unit of the city. It derives its coherence as a unit both from the forces which hold its own elements together and from the dynamic coherence of the larger living system which includes it as a fixed invariant part.

Other examples of systems in the city are: the set of particles which go to make up a building; the set of particles which go to make up a human body; the cars on the freeway, plus the people in them, plus the freeway they are driving on; two friends on the phone, plus the telephones they hold, plus the telephone line connecting them; Telegraph Hill with all its buildings, services and inhabitants; the chain of Rexall drug stores; the physical elements of San Francisco that fall under the administrative authority of City Hall; everything within the physical boundary of San Francisco, plus all the people who visit the city regularly and contribute to its development (like Bob Hope or the president of Arthur D. Little), plus all the major sources of economic welfare which supply the city with its wealth; the dog next door, plus my garbage can, plus the garbage out of my garbage can which he lives on; the San Francisco chapter of the John Birch Society.

Each one of these is a set of elements made coherent and co-operative by some sort of inner binding forces. And each one, just like the traffic light - newsrack system, has a physically fixed part which we think of as a unit of the city.

Of the many, many fixed concrete subsets of the city which are the receptacles for its systems and can therefore be thought of as significant physical units, we usually single out a few for special consideration. In fact, I claim that whatever picture of the city someone has is defined precisely by the subsets he sees as units.

Now, a collection of subsets which goes to make up such a picture is not merely an amorphous collection. Automatically, merely because relationships are established among the subsets once the subsets are chosen, the collection has a definite structure.

To understand this structure, let us think abstractly for a moment, using numbers as symbols. Instead of talking about the real sets of millions of real particles which occur in the city, let us consider a simpler structure made of just half a dozen elements. Label these elements 1,2,3,4,5,6. Not including the full set [1,2,3,4,5,6], the empty set [-], and the one-element sets [1],[2],[3],[4],[5],[6], there are 56 different subsets we can pick from six elements.

Suppose we now pick out certain of these 56 sets (just as we pick out certain sets and call them units when we form our picture of the city). Let us say, for example, that we pick the following subsets: [123], [34], [45], [234], [345], [12345], [3456].

What are the possible relationships among these sets? Some sets will be entirely part of larger sets, as [34] is part of [345] and [3456]. Some of the sets will overlap, like [123] and [234]. Some of the sets will be disjoint - that is, contain no elements in common like [123] and [45].

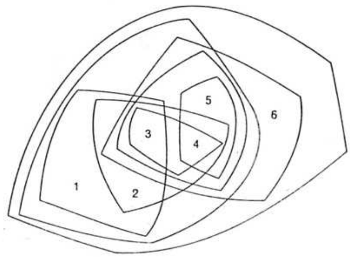


Diagram A

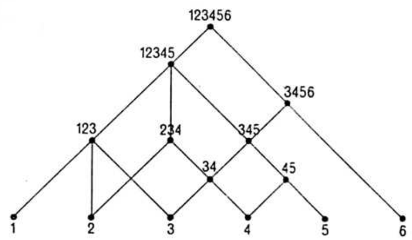


Diagram B

We can see these relationships displayed in two ways. In diagram A (above) each set chosen to be a unit has a line drawn round it. In diagram B the chosen sets are arranged in order of ascending magnitude, so that whenever one set contains another (as [345] contains [34], there is a vertical path leading from one to the other. For the sake of clarity and visual economy, it is usual to draw lines only between sets which have no further sets and lines between them; thus the line between [34] and [345] and the line between [345] and [3456] make it unnecessary to draw a line between [34] and [3456].

As we see from these two representations, the choice of subsets alone endows the collection of subsets as a whole with an overall structure. This is the structure which we are concerned with here. When the structure meets certain conditions it is called a semilattice. When it meets other more restrictive conditions, it is called a tree.

The semilattice axiom goes like this: *A collection of sets forms a semilattice if and only if, when two overlapping sets belong to the collection, the set of elements common to both also belongs to the collection.*

The structure illustrated in diagrams A and B is a semilattice. It satisfies the axiom since, for instance, [234] and [345] both belong to the collection and their common part, [34], also belongs to it. (As far as the city is concerned, this axiom states merely that wherever two units overlap, the area of overlap is itself a recognizable entity and hence a unit also. In the case of the drugstore example, one unit consists of newsrack, sidewalk and traffic light. Another unit consists of the drugstore itself, with its entry and the newsrack. The two units overlap in the newsrack. Clearly this area of overlap is itself a recognizable unit and so satisfies the axiom above which defines the characteristics of a semilattice.)

The tree axiom states: *A collection of sets forms a tree if and only if, for any two sets that belong to the collection either one is wholly contained in the other, or else they are wholly disjoint.*

The structure illustrated in diagrams C and D (below) is a tree. Since this axiom excludes the possibility of overlapping sets, there is no way in which the semilattice axiom can be violated, so that every tree is a trivially simple semilattice.

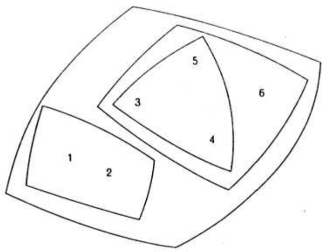


Diagram C

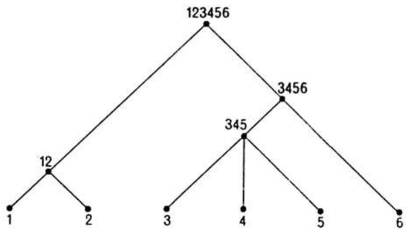


Diagram D

However, in this paper we are not so much concerned with the fact that a tree happens to be a semilattice, but with the difference between trees and those more general semilattices which are not trees because they do contain overlapping units. We are concerned with the difference between structures in which no overlap occurs, and those structures in which overlap does occur.

It is not merely the overlap which makes the distinction between the two important. Still more important is the fact that the semilattice is potentially a much more complex and subtle structure than a tree. We may see just how much more complex a semilattice can be than a tree in the following fact: a tree based on 20 elements can contain at most 19 further subsets of the 20, while a semilattice based on the same 20 elements can contain more than 1,000,000 different subsets.

This enormously greater variety is an index of the great structural complexity a semilattice can have when compared with the structural simplicity of a tree. It is this lack of structural complexity, characteristic of trees, which is crippling our conceptions of the city.

Artificial cities which are trees

To demonstrate, let us look at some modern conceptions of the city, each of which I shall show to be essentially a tree. It will perhaps be useful, while we look at these plans, to have a little ditty in our minds:

> “Big fleas have little fleas
> Upon their backs to bite 'em;
> Little fleas have lesser fleas,
> And so ad infinitum.”

This rhyme expresses perfectly and succinctly the structural principle of the tree.

Examples

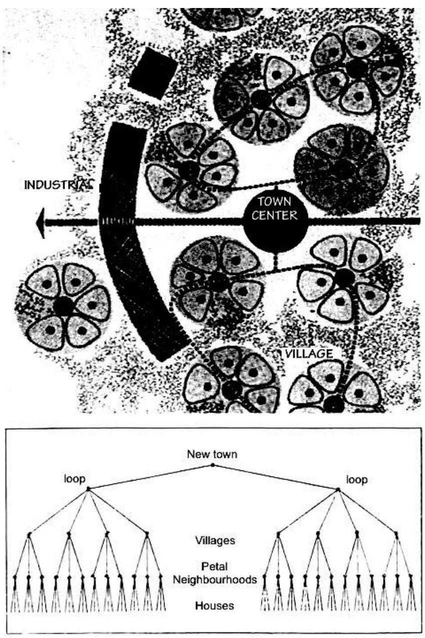


Figure 1. Columbia, Maryland, Community Research and Development, Inc.: Neighbourhoods, in clusters of five, form 'villages'. Transportation joins the villages into a new town. The organization is a tree.

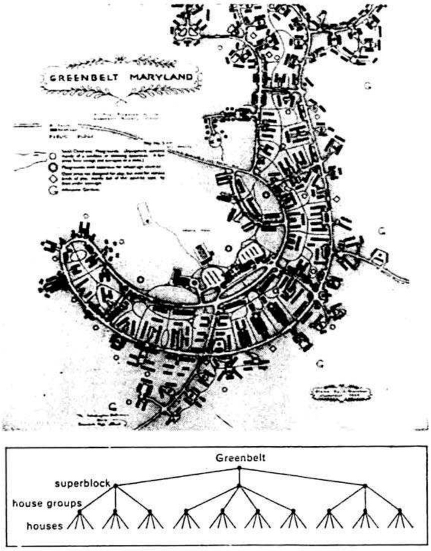


Figure 2. Greenbelt, MD., Clarence Stein: This 'garden city' has been broken down into superblocks. Each super-block contains schools, parks and a number of subsidiary groups of houses built around parking lots. The organization is a tree.

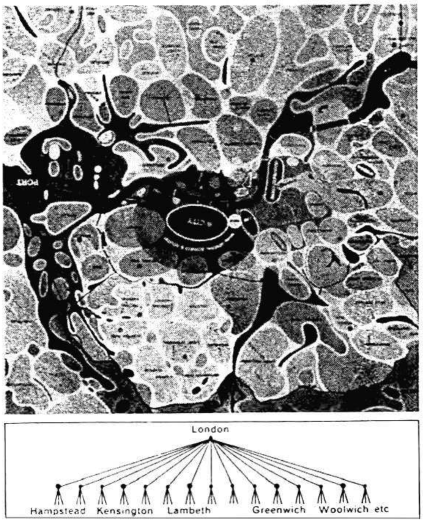


Figure 3. Greater London plan, Abercrombie and Forshaw: The drawing depicts the structure conceived by Abercrombie for London. It is made of a large number of communities, each sharply separated from all adjacent communities. Abercrombie writes, 'The proposal is to emphasize the identity of the existing communities, to increase their degree of segregation, and where necessary to recognize them as separate and definite entities.' And again, 'The communities themselves consist of a series of sub-units, generally with their own shops and schools, corresponding to the neighbourhood units.' The city is conceived as a tree with two principal levels. The communities are the larger units of the structure; the smaller sub-units are neighbourhoods. There are no overlapping units. The structure is a tree.

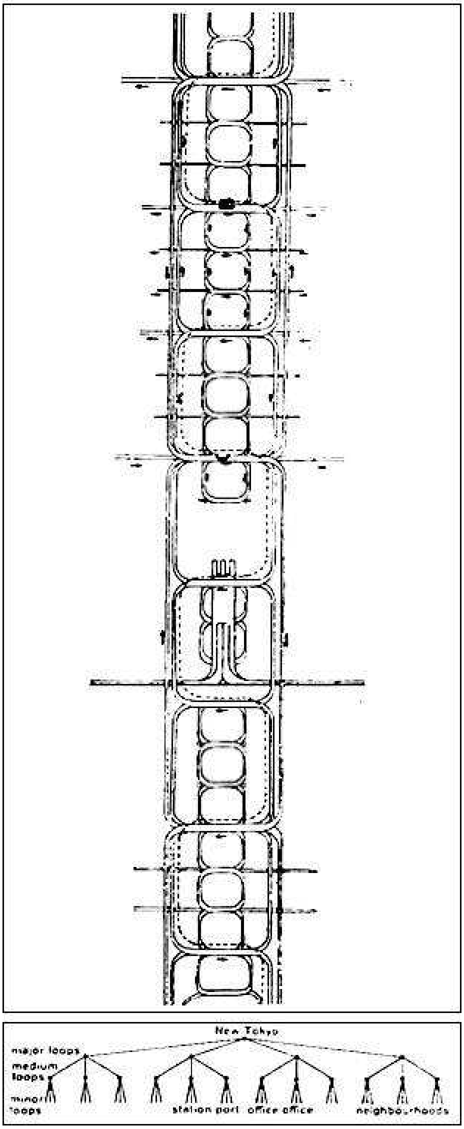


Figure 4. Tokyo plan, Kenzo Tange: This is a beautiful example. The plan consists of a series of loops stretched across Tokyo Bay. There are four major loops, each of which contains three medium loops. In the second major loop, one medium loop is the railway station and another is the port. Otherwise, each medium loop contains three minor loops which are residential neighbourhoods, except in the third major loop where one contains government offices and another industrial offices.

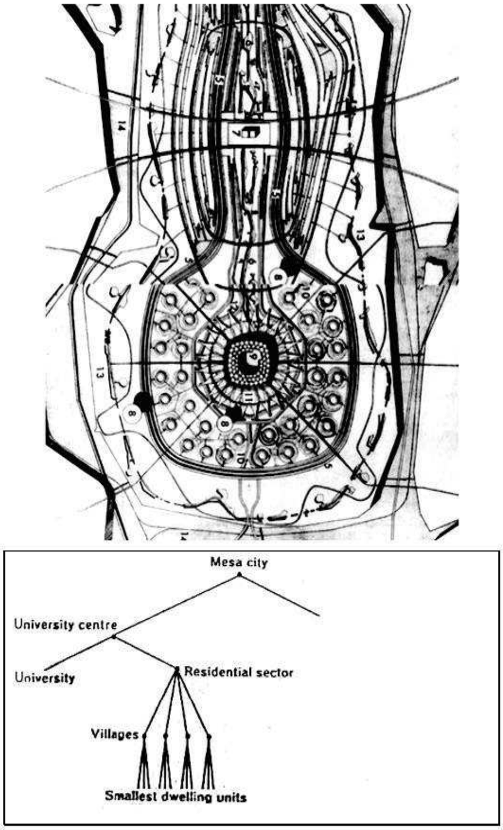
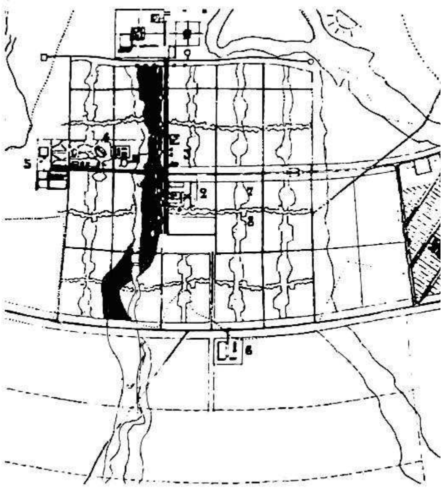


Figure 5. Mesa City, Paolo Soleri: The organic shapes of Mesa City lead us, at a careless glance, to believe that it is a richer structure than our more obviously rigid examples. But when we look at it in detail we find precisely the same principle of organization. Take, particularly, the university centre. Here we find the centre of the city divided into a university and a residential quarter, which is itself divided into a number of villages (actually apartment towers) for 4000 inhabitants, each again subdivided further and surrounded by groups of still smaller dwelling units.



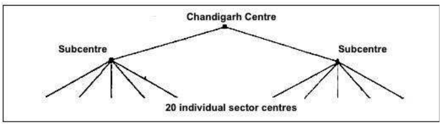


Figure 6. Chandigarh, Le Corbusier: The whole city is served by a commercial centre in the middle, linked to the administrative centre at the head. Two subsidiary elongated commercial cores are strung out along the major arterial roads, running north-south. Subsidiary to these are further administrative, community and commercial centres, one for each of the city's 20 sectors.