DEPARTMENT OF ARCHITECTURE AND BUILDING SCIENCE
UNIVERSITY OF STRATHCLYDE

ECOLOGY, SUSTAINABILITY AND THE CITY
Towards an Ecological Approach to Environmental Sustainability: with a case study on Arcosanti in Arizona

Volume Two: The Arcology Model and the Arcosanti Laboratory

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Abstract

As the world population moves toward 10 billion people over the next 50 years environmental decline seems inevitable unless changes are implemented. Issues of *ecology, sustainability and the city* are now being recognised as critical. The systemic and holistic nature of the problem means that sustainable policies must address a wide range of social issues, political attitudes, economic practices and technological methods. *Volume One* offers a wide-ranging and comprehensive review of *Environmental Problems and Sustainability* and seeks to map out both the historical and contemporary basis for a widespread transition towards a more sustainable society.

The world's cities now offer the critical context within which sustainable strategies can be developed and tested. Much current academic and policy literature describes a range of sustainable development models representing radically different views of how the processes leading towards the planning and implementation of cities needs to be realised. *Volume Two* describes Paolo Soleri's *Arcology Model and the Arcosanti Laboratory* as a relevant methodology and case study. The arcology model attempts to address issues of sustainability by advocating a balanced relationship between urban morphology and performance within cities designed to conform to the complexity - miniaturization - duration (CMD) paradigm. The methodology recognises the need for the radical reorganisation of urban sprawl into dense, integrated compact urban structures in which material recycling, waste reduction and the use of renewable energy sources are part of a sustainable strategy aimed at reducing the flow of resources and products through the urban system.

As governments, eager to deliver major environmental improvements, press on with, as yet, untried and untested 'centrist' urban policies, there is a need to research relevant models of compaction. Over the last ten years, as the criteria of urban sustainability have become more widely accepted and understood the relevance of the Soleri's model has become clearer. Arcosanti in Arizona , begun in 1970, offers a laboratory for testing the validity of the theory. Volume Two concludes by critically reviewing arcology and Arcosanti in the context of the discourse on sustainability offered in Volume One. Since the energy crisis of the mid-1970s efforts at Arcosanti have been directed toward the definition and testing of various architectural effects that, when combined, could offer a response to many of today's environmental problems. But today progress is painstakingly slow. Lacking the level of funding and resources that would enable it to be convincing, it now represents not so much a specific prototypical solution but an activist engaged strategy that advocates the possibility of building our dreams and visions. In a world plagued by so many problems, and so few alternatives, it continues to offer a beacon of hope for a sustainable future.

Aim and structure of the thesis

The aim of this thesis is to firstly appraise the notion of ecological limits to population, economic and urban growth and to examine the implications of exceeding growth limits, both on a global scale and in relation to generic problems associated with local urban environments, in developed and developing nations. An analysis of social, political, economic and technological aspects of sustainability will provide the context for a review of contemporary sustainable urban planning and development issues and for a synopsis of the current debate on urban compaction versus decentralisation. In the final part of the work the aim is to locate the arcology theory, as an alternative model of urban development, and the laboratory at Arcosanti in Arizona, within the context of the current debate on urban sustainability and to describe and critically review its theoretical and practical response to today's social, ecological and environmental problems.

Having lived, worked and studied at Arcosanti for a few years in the late 1980s, and having then researched and taught ecological aspects of architecture and urban sustainability at Strathclyde University during the 1990s, it seems appropriate to draw the strands of my own experience together with the growing theoretical body of knowledge in the area of environmental studies. The work is structured into two volumes encompassing nine chapters.

Volume One — Environment Problems and Sustainability

Part 1 — The Global Environment

Part 1 reviews various historical and contemporary accounts of global environmental limits to population, economic and urban growth and examines the implications of going beyond such limits.

A mismatch currently exists between the global *green agenda* on the one hand, relating to world wide problems of resource depletion, loss of biodiversity, accelerating pollution, and global warming, and the urban *brown agenda* on the other, involving social and environmental problems within growing cities. The approach taken here is to distinguish between them for the purposes of study, while recognising that they are essentially interrelated and inseparable. Ultimately by focusing more on the urban environment the argument is not for less attention to be paid to global concerns, but for the recognition that urban and global concerns are inter-related, and planning and policy measures aimed towards sustainability must, of necessity, address both.

Chapter 1 - focuses on issues relating to maintaining the balance and integrity of the biosphere, while highlighting the scale and extent of specific green agenda problems.
Chapter 2 - looks in more detail at the Limits to Growth *thesis and examines its implications in both the developed and developing nations of the world.*

Part 2 The Urban Environment

Part 2 focuses on the scale and character of contemporary urbanisation and the rapid growth of cities, particularly within the developing nations, and examines associated urban environmental problems.

Historical and current patterns of rural-urban migration and urban demographics are discussed within the present context of the emergence of huge mega-cities and the economic, political, and socio-cultural re-structuring of modern life implied by the phenomenon of globalisation. The question arises as to whether an urban revolution of such scale and celerity is sustainable, particularly in the context of urban convergence theory suggesting that globally cities are becoming more alike in their most problematic characteristics. Along with the current pattern of growth of large cities has come a whole host of *brown agenda* problems relating to issues of human health and well being and environmental degradation, such as unemployment and poverty, inadequate shelter, sanitation and water supplies, congestion, and increased air pollution. Urban lifestyles and consumption patterns within today's cities account for the majority of the world's energy burden and natural resource depletion.

Chapter 3 - focuses on the process of urbanisation and urban growth.
Chapter 4 examines some of the social and environmental problems associated with current urban development patterns.

Part 3 Sustainability

Part 3 reviews the growth of ecologism and the ecological paradigm as a response to global and urban social and environmental problems and describes recent proposals, planning objectives and policy measures aimed at achieving sustainability at both the global and urban scales.

We, in the developed world, continue to grow at the cost of others' ability to develop. Sustainable development policies, in recognising that the world's problems are interconnected and interdependent, must be implemented in a holistic process that addresses simultaneously the social, political, economic and technological aspects of sustainability. Building an urban culture of sustainability that will promote environmental (and economic) stability and ecological sanity and, at the same time, emphasise the well-being of people throughout the world and their long term needs is a fundamental challenge of the twenty-first century. Human self-interest demands that sustainable relationships between the city and the biosphere are established. But this will not happen unless we make profound changes to the value systems underpinning our cities, including adopting new political attitudes, economic practices and technological methods within a social milieu that promotes spiritual and ethical growth, and values quality over quantity.

Chapter 5 - investigates the emergence of ecologism and traces the ideology's historical and modern roots.
Chapter 6 examines the social, political, economic, and technological aspects of the ecological paradigm for a sustainable society.
Chapter 7 reviews recent frameworks, planning strategies, and alternative models for sustainable urban development.

Volume 2 The Arcology Model and the Arcosanti Laboratory

Volume2 examines arcology (architecture and ecology) as a relevant methodology and Arcosanti as an urban laboratory that attempts to confront the most critical areas of sustainability.

By advocating an urban system and structure that adopts a balanced relationship between its morphology and performance *arcology* offers a theoretical response to problems of population expansion, scarcity of land resources and energy, pollution, technological mindlessness, waste, greed, cultural, social and spiritual deprivation. The arcological model of sustainable urban development sees, in the contraction and greater sophistication of the city (including all its equipment, machinery, infrastructure, services, etc.), both the efficient possibility of achieving more with less and the chance of reaching new levels of spiritual development. Such transformation involves a radical revision of the current social, cultural, political and economic structure. The systemic nature and complexity of the sustainability imperative requires that we explore alternatives that might offer a community-wide holistic response to ecological, social and environmental problems. At the urban laboratory at *Arcosanti*, in Arizona, Paolo Soleri has been exploring such an alternative since 1970, by attempting to build and operate a working prototype arcology. Volume 2 concludes by critically reviewing Soleri's model in the context of the discourse on sustainability offered in Volume One.

Chapter 8 examines the arcology model, traces its 20th century genealogy and describes its subsequent evolution.

Chapter 9 relates the history, development and current status of the Arcosanti project.

Vol. 2

The Arcology Model and the Arcosanti Laboratory

Volume2 examines arcology (architecture and ecology) as a relevant methodology and Arcosanti as an urban laboratory that attempts to confront the most crucial areas of sustainability. It concludes with a critical analysis and an assessment of its validity in response to the challenges described in Volume One

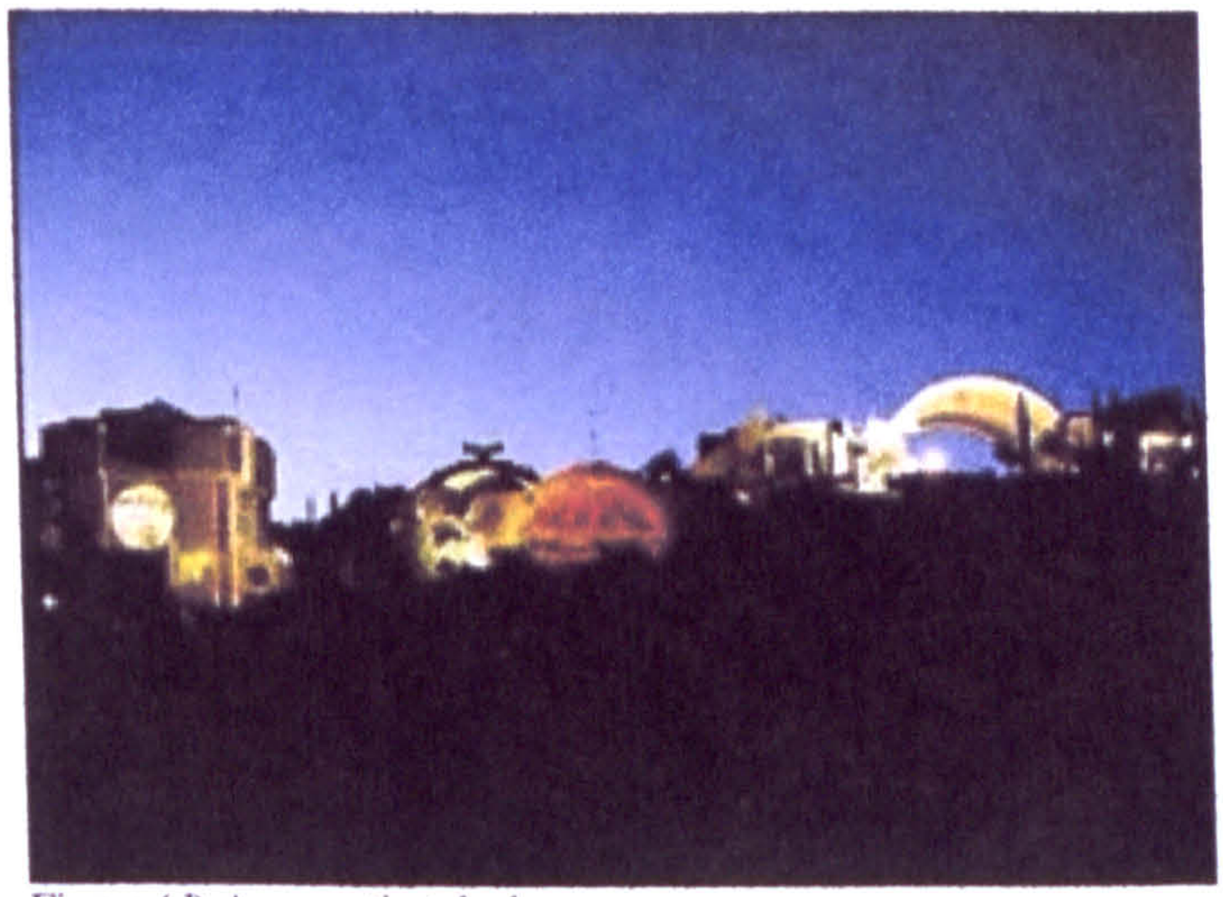

Figure (d) Arcosanti at dusk

Chapter 8 examines the **arcology theory**, *traces its 20th century genealogy and describes its subsequent evolution.*
Chapter 9 relates the history, development and current status of the **Arcosanti** *project.*

Introduction to Volume Two

Introduction to Volume Two

Models for sustainable urban development

The revolutionary changes needed to address the questions of urban sustainability adequately will take a huge amount of imagination and political will. If we are to hand on a decent living environment to future generations, we need to institute radically different collective thought processes that are able and willing to engage in discussions about possible alternative futures in a rapidly urbanising world.

The sustainability imperative now has political priority status and governments are demanding a planned response to global and urban environmental problems that is based on both solid theoretical foundations and hard technical evidence.

The concept of sustainable development has been rightly criticised as being too vague and contradictory. We need to find the inspiration to deal innovatively with environmental problems but there currently seems to be a lack of new ideas concerning the future of our society. Big ideological differences do not seem to exist any more and there is a lack of grand

'metanarratives' and inspiring ideas of the kind described by Howard, Le Corbusier and Frank Lloyd Wright. Some might argue that this is just as well. However in their absence it is proving very difficult to initiate debate in which the current orthodoxy, including current patterns of urban growth, can be adequately criticised. The question arises; who will create an environmentally sustainable society?

More recently however, within the academic and policy literature that has emerged from the growing debate around sustainable cities, a number of different approaches are beginning to be considered. A number of "models" of sustainable urban development have been developed which represent radically different views of how the processes leading towards the planning of sustainable cities needs to be realised. These vary from the deep ecology inspired attempts to bring about the self-reliant city, to more neo-liberal attempts to foster sustainable development by redefining the market pricing and regulatory systems. Haughton (1999) describes some of these contemporary alternative models as:[1]

- The *free-market model* - generally focusing on non-spatial views of economists seeking a response to urban environmental problems through altering market mechanisms. This 'light green' approach to sustainable development sees de-regulated global trade and trickle down methods of wealth distribution as the solution to environmental damage and social malaise. Environmental problems are thus subordinated to economic efficiency.
- The *re-designing the city model* - where a main theme is that re-designing the physical fabric of the existing city can improve resource efficiency. The rapid urban decentralisation, which has occurred in Western countries since WW II, has resulted in a low-density sprawling form of growth. This, in turn, results in an increasingly fragmented spatial experience, with increased distances between places where people live, work, and use urban services. This adds impetus to the tendency towards heavy car-reliance, and requires considerable consumption of land and energy.
- The *self-reliant city model* - derives from the green anarchist tradition and the rejection of the state, class politics, parliamentary democracy and capitalism. Influenced by ecological utopian perspectives, particularly those "utopias of sufficiency"[2]of William Morris (*News From Nowhere*, 1891) and Peter Kropotkin (*The Conquest of Bread*, 1892), they owe a more contemporary debt to the work of Murray Bookchin (1974), and Richard Register (1987). Embracing most of the key tenets of the radical green approach to sustainability, the

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[1] Haughton, (1999)
[2] M. de Geus, *Ecological Utopias: Envisioning the Ecological Society* (International Books, Utrecht, 1999), p. 20-2

preservation of nature is a major concern, in particular designing cities that maintain a balanced relationship with the surrounding environment. This preservationist or 'frugal' stance to natural resource use is usually interpreted as minimising urban impacts on all natural assets including a general commitment to reducing the 'ecological footprint' of the city. Kirkpatrick Sale's (1985) bioregional vision[3] becomes one of the main building blocks for the sustainable city-region, with inhabitants using the bioregion's resource rather than importing, and absorbing wastes locally, rather than exporting "negative external effects"[4] in the form of pollution.

In terms of the engagement with the hinterland the approach is to reduce the number and frequency of exchanges and to build up local economies based upon local resources. The emphasis tends to be placed on small-scale production systems for local need, using appropriate local technologies, rather than on large-scale production for the global markets using imported, expensive, high-technology, capital intensive production systems. Growth is focused primarily on environmentally benign products and services. In many ways Arcosanti adopts the characteristics of the *self-reliant city model.* Some forms of exchange with external areas are accepted as necessary, but the goal is to minimise these. This level of introspection however "raises fears of regional autarky linked to technological, cultural and other forms of stagnation".[5]

- The *fair shares city model* - involves achieving a balance between 'ecological footprint' concerns and those of maintaining a sustainable level of trade between a city-region and its hinterland. In essence this model takes many of the features of the previous two models (e.g. increased regional autarky and greater urban compaction) and adds these to tools for establishing more equitable trading relationships with other areas. Because it focuses on changing relationships there are also potentially close ties with the *free-market model* of the externally dependent city. The main difference involves the existence of trade regulations relating to environmental assets (including compensation mechanisms) that would be in place in the fair shares city. In this sense the model is one of quasi-autarky where some trading in environmental assets is seen as essential to human development. The argument is that it should be possible to establish a mutually beneficial relationship of fair trading in environmental resources and pollution without breaching local or global ecological tolerance limits. In contrast to the 'hands-off the hinterland' approach of the self-reliant model, and the

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[3] K. Sale, *Dwellers in the Land: the Bioregional Vision* (1985)
[4] Pigou, *The Economics of Welfare* (1920), pp 183-4.

'geographical neutrality' of the externally dependent city, the fair share city is more closely tied into the surrounding area.

Although this model appears to offer a pragmatic compromise of certain radical aspects of the others and might also be seen to address the ideological concern that cities should 'pay their way', it is the least developed within environmental literature.

Arcology

A fifth model representing a radically different view of how the sustainable city might be realised and one which has, until recently, been largely overlooked in much of the academic and policy literature, involves the ecological design work dating back to the 1950s of the architect and visionary, Paolo Soleri:

- The *arcology city model* or *ecological city model* - embodies the fusion of architecture with ecology. The concept proposes a highly integrated and compact three-dimensional urban form that is the opposite of urban sprawl with its inherently wasteful consumption of land, energy, time and human resources. These urban structures are called *arcologies.* An arcology would need about two percent as much land as a typical city of similar population. The car is eliminated from inside the city and reserved for use outside. Walking becomes the main form of transportation. The city is designed to improve the life quality of its inhabitants, and to be highly efficient in the processes of production and consumption. The central tenet of Soleri's theory is that cities must miniaturise and become more complex in order to survive. The miniaturisation of the city enables radical conservation of land, energy and resources. An arcology would rely as much as possible on the sun, the wind and other renewable energy sources so as to reduce pollution and dependence on fossil fuels:

> The problem I am confronting is the present design of cities only a few stories high, stretching outward in unwieldy sprawl for miles. As a result of their sprawl, they literally transform the earth, turn farms into parking lots and waste enormous amounts of time and energy transporting people, goods and services over their expanses. My solution is urban implosion rather than explosion.[6]

Such urban structures would need less energy per capita thus making recycling and the use of solar energy more feasible than in present cities. Influenced by Teilhard de Chardin's 'point Omega ' hypothesis, Soleri's ideas on ecological cities have, in turn, influenced many

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[5] G. Haughton, 'Developing models of sustainable urban development', in *Cities,* 14 (4), (1997) pp. 189-195

[6] P. Soleri *Earth's Answer* (Lindisfarne Books, 1977)

architects involved with ecological design (including Richard Register (1987)[7]; Peter Calthorpe (1993); Jon Jerde [architect of Horton Plaza in San Diego]), architectural educators (including Marcos Novak [Visiting Professor of Architecture and Urban Design at UCLA; and Founding Director of the Reality Lab at the School of Architecture, University of Texas]and Ron McCoy [Director, School of Architecture, Arizona State University], theologians (including Harvey Cox, Professor of Divinity at Harvard: and John B. Cobb, Professor of Theology at Claremont), Science Fiction writers (including William Gibson [*Neuromancer,* 1984]; and Larry Niven [*Oath of Fealty,* 1987] and [*The California Voodoo Game,* 1992]), and a new generation of cyberspace technology entrepreneurs and critics (including Erik Davis [*TechGnosis: Myth, Magic & Mysticism in the Age of Information*]; Mark Pesce [Internet visionary, co-inventor of VRML - the Virtual Reality Modelling Language]; and Coco Conn [Creator of the CitySpace Project]).

Arcology's methodology sees material recycling, waste reduction, energy conservation, and the use of renewable energy sources as part of strategy for sustainability aimed at reducing the flow of resources and products through the urban system. As more people have become aware of the need to develop new approaches and new paradigms appropriate to modern environmental and social problems Soleri's views on the *ecological city* have been more widely sought. There are also signs that, as the balance of the urban sustainability discourse begins to move away from theory and into the realm of practical policies and of urban forms that could contribute to achieving a more sustainable future, the work at Arcosanti, Soler's *urban laboratory* in Arizona, is attracting a resurgence of interest.

Typically today's cities devote up to sixty percent of their land for car functions. An arcology would need about two percent as much land as a typical city of similar population since it eliminates the car from inside the city and reserves it for use outside the city. Walking becomes the main form of transportation inside. Arcology would rely as much as possible on the 'soft technologies' of sun and wind power and other renewable energy so as to reduce pollution and dependence on fossil fuels. Because it needs less energy per capita the arcology model renders recycling and the use of solar energy more feasible than in present cities.

Urban utopians such as Tony Garnier (*Une Cité Industrielle,* 1917); Le Corbusier (*La Ville Contemporaine*, 1922 and *La Ville Radieuse*, 1933); Frank Lloyd Wright (*Broadacre City,* 1934), Constantin Doxiades (*Ecumenopolis*, 1969), and Paolo Soleri (*Arcology*, 1969) have approached the problem of societal change by first redefining the form and infrastructure of the

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[7] R. Register, *Ecocity Berkeley: Building Cities for a Healthy Future* (North Atlantic Books, Berkeley, CA., 1987)

city. Marius De Geus has recently made the distinction between *'ecological utopias'* or 'utopias of sufficiency' on one hand (including the "ecotopias" of More, Thoreau, Kropotkin, Morris, Howard, Callenbach and Bookchin), and 'technological utopias' or 'utopias of abundance' on the other (including, among others, the "technotopias" of Bacon, Owen, De Saint-Simon, Fourier and Bellamy). The main difference between them, he suggests, lies in the notion of whether an ideal society should be based on luxury and excess or moderation and frugality. The notion of utopia as a blueprint for a new society or a fixed model of the future has been rightly rejected but utopia thinking can also be used as a 'critical norm', offering criteria against which to measure current social development. Alternative visions of the future can present themselves for discussion, critique and transformations. Since the relationship between sustainability and urban form is now being recognised as critical, by referring both to classical and recent ecotopian thinkers we might be better placed to contribute to the social debate on sustainability. Soleri's *Arcology* can be considered as operating within such an 'ecotopian' tradition.

Soleri contends that many of the problems that afflict modern society are as a direct consequence of the sprawling pattern of twentieth century urban development. What sets him apart from his contemporaries, and tends to encourage comparisons with Ebenezer Howard, is his radical approach to solving these problems, the sheer scale of his vision, and his determination, since 1970, to test his hypothesis by building a prototype at Arcosanti in Arizona.

Indeed there are similarities between Soleri's arcological approach and Howard's ideas on the *Garden City*. Both believe that the town and the country can co-exist happily and be mutually dependent. Both advocate the establishing limits to the physical dimensions of the town and leaving the agricultural hinterland undeveloped. Citizens in a Garden City and in an arcology would work in the city but would be close to the countryside, while the rural community, working mostly in agriculture, would have the benefits of proximity with the city and could share in its social and cultural life. Howard's formulation of ecological preconditions was intended to maintain self-sufficiency while guiding industrial activities and a large portion of the policy-making choices. Environmental considerations were, in this way, fully immersed in planning and social structures. Soleri's ecological foundations within the *complexity - miniaturisation - duration (CMD) paradigm* underpins his arcological thinking and has determined the evolution of the concept, and the development of various generations of arcologies, since the Mesa City project from 1958. But while ecology is at the root of both approaches, for Howard the 'natural' environment forms a basis for architectural and social planning. But Soleri's goal lies in the definition of a new kind of environment that he calls *"neonature"*, a new human-made physical layer designed to support biological, human, and

social evolution while containing human societies along with all their material goods. Howard's decentralised ecological approach to town planning has been criticised for underestimating the ecological benefits of urban life. A central tenet of Soleri's centralised arcological approach is that the city is a necessary instrument for the evolution of humankind.

In seeking a truly 'urban' solution Soleri is pursuing the objectives, which have occupied since he left *Taliesin West* in 1949. His apprenticeship with Frank Lloyd Wright was short lived. Rather than accept Wright's notion of decentralisation, as manifest in *Broadacre City* (1934 - 1958) Soleri has, since the 1950s, envisaged a re-orientation of city life through a process of *urban implosion,* wherein the city is compacted and intensified, made three-dimensional and pedestrian and designed to conserve the earth's energy and resource. Rather than accept the inevitability of the outward drift of cities Soleri rejects *Ecumenopolis* (Doxiadis, 1969) as representing a frightening "map of despair".[8] Looking at the same emerging realities of urban sprawl he takes human society in an entirely different direction by attempting to draw the city's elements back together towards a revolutionary new kind of human environment within arcologies leaving the rest of nature to develop on its own terms. Some of these proposed structures contain populations of millions,

Influenced by Teilhard de Chardin, Soleri's vision proposes the building of the *Civitas Dei* as the next step in the progressive transformation of human existence. What he terms, the *urban effect* is the principle whereby human interaction creates new forms and levels of individuality and community. The stated function of arcology is to ease the breakthrough to these new levels. According to John Cobb (1981), if humanity gains its meaning from its place in the evolutionary process then the relevance of Soleri's urban vision is that it offers hope for the future in the progressive transformation of human existence.[9]

Of course there are great risks associated with attempting to create a model for an ideal society. The idea of unity tends towards uniformity. Popper's criticism that no single objective, absolute truth exists nor can be expressed in a blueprint is now generally accepted along with the criticism that utopias are not realistic because they generally fail to provide a plausible strategy for change. The dangers of seeking ultimate happiness an attempting to achieve political perfection are now generally recognised. Radically breaking with the past and implementing large-scale changes all at once is a high-risk strategy, not least because it would be impossible for a new social model to eliminate existing problems without having them replaced by a set of

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[8] P. Soleri, *Arcology: The City in the Image of Man* (MIT Press, Cambridge, Mass., 1969), p. 2
[9] J. B. Cobb, Preface to P. Soleri, *The Omega Seed: An Eschatological Hypothesis,* (Anchor Press/Doubleday, Garden City, New York, 1981), p. 16

new ones. In defining a definitive final condition, utopias, since they are already perfect, need no further improvement and are basically static.

Paolo Soleri argues that an arcology would be 'anti-utopian' by design and content. Rather than seek perfection (through 'self-containment' of the habitat) in the evolution of the theory since the 1950s, the attempt has been to define a methodology and illustrate it in various 'generations' or 'models'.

The model described within the *Two Suns Arcology* (1975) concept is capable, at least theoretically, of demonstrating positive responses to the many problems of the urban environment, including those of population, pollution, energy and natural resource depletion, food scarcity and quality of life. Its methodology recognises the necessity of the radical reorganisation of the sprawling urban landscape into dense, integrated, three-dimensional cities. Soleri contends that the city structure must contract, or miniaturise, in order that it can support all the complex activities that sustain human culture and give it a new perception and a renewed trust in society and its future. The metaphor for the city "in the image of man" emphasises the idea of 'self-containment' rather than self-sufficiency. Without self-containment the city cannot act effectively with the surrounding natural environment. When the city loses sustenance from the countryside it is doomed. Recycling, waste reduction, energy conservation and the use of renewable energy sources become part of a sustainable strategy aimed at reducing the flow of resources and products through the urban system. In particular the arcology concept responds to the urban environmental problems related to land use, transportation, food and energy production, impact on natural resources and pollution. The development of the Two Suns Arcology produced some highly significant environmental effects (*greenhouse effect, horticultural effect, apse effect, chimney effect, and the heat sink effect*) and it gave greater priority to the Sun as the main source of renewable energy. It also placed the arcology concept much more firmly into its own ecological niche. The ideas that emerged within the concept of the 'energy city' served to reinforce the relationship between architecture and ecology. The development of the *Hyper Building* arcology concept from 1995 draws together many of these environmental benefits, in one large building.

Arcosanti

An urban laboratory is taking shape at *Arcosanti* (meaning 'architecture before things' or 'anti-materialist architecture') in Arizona. When complete it will be a small town of around 6,000 people, built on only 15 acres of a 860 acre land preserve in Arizona's semi-arid high desert region. It aims to combine a compact urban structure with large-scale solar greenhouses. Since

1970 Soleri has used Arcosanti to rethink modern urban design and planning from the ground upwards. Instead of accepting the logic of two-dimensional cities, and what he sees as the inherent wastefulness of suburban sprawl, he has developed Arcosanti as a laboratory to explore the idea of urban "implosion", where the city infrastructure contracts and intensifies in order to become more efficient, ecological, and sustainable. Shortly after work had started on Arcosanti the American publication *Newsweek* described it as "probably the most important urban experiment in our times". To those in search of an alternative urban environment it offers thirty years of experimentation in this field.

In early built projects, from the partially earth-bermed *Cave Creek Dome House* (1949), incorporating a passive heating and cooling system, and the process-led design for *Ceramica Artistica Solimene* (1951-2) Soleri developed his particular approach to ecological architecture. He continued his experimental approach in a series of *silt-casting* workshops focusing on the construction of a number of earth structures at Cosanti, in Scottsdale. The technique of *silt-casting* involves the use of river silt to make moulds and forms for the casting of various materials including clay, plaster, wax, and concrete. The technique has been used to produce, architectural models and the, now famous, bronze and ceramic wind-bells. Adapting the method to create habitable structures was the next logical step. The result is a complex of partially submerged buildings that are used as craft studios, a foundry, work areas, offices and residences for the Cosanti Foundation, an organisation dedicated to pursuing the research and development of an alternative urban environment.

Although the site was purchased in 1970, construction work at Arcosanti began in 1971. The construction of the first main structures involved extensive silt casting using the silt from the Agua Fria River bed that runs through the land. Unlike the buildings at Cosanti, the cast-in-place or pre-cast structures at Arcosanti are mostly constructed above ground using a similar, but more sophisticated earth-casting technique. The concrete structures, many characterised by the apse form, constitute a cluster of various structures and spaces built on a south-facing mesa. These currently define the living, working and learning environment for a community of around one hundred residents.

Arcosanti is intended to be a laboratory for the purpose of investigating the process of designing building and operating a functioning prototype arcology. It is a framework, for various experiments within the field of environment and habitat and for research within the complexity - miniaturisation - duration (CMD) paradigm. The premise of the research work is that, since the urban phenomenon is seen as a process of increasing complexity, which must take place in proportionally shrinking spaces, then the miniaturization of its structure is an imperative. More

specifically Arcosanti aims at constructing a living demonstration of a compact three-dimensional town as a proposed alternative to suburban sprawl and all its inherent social and environmental problems. Since it is largely self-financed the project, of necessity, has had to be a simple assessment of the urban phenomenon and a modest attempt to contribute to it.

As well as the ongoing construction work, there are many projects at Arcosanti which involve the community in a wide variety of activities ranging from project development, networking and media work, research activity, exhibitions, drafting work, conference organisation to wind-bell production and site maintenance. These including *Construction Workshops; Arcosanti Organics; Energy Apron* and *Greenhouse Experiments; Minds for History; Paradox; Arcosanti 2000*; and *Arcosanti Super Critical Mass.*

8

Arcology

Chapter 8

8.0 THE ARCOLOGY MODEL

The city is an organism in a constant process of complexification. Nature shows that for all organisms or society of organisms with any increment of complexity, there corresponds a spatio-durational contraction of its functions. Complexity is a function of miniaturization. This is a rule that… cannot be amended by politics, economy, religion, science, or philosophy… Structure comes before performance.[9]

Figure 8.1 Images of Arcology

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[9] Soleri, *Arcology* (1969), p. 122

8.1 Paths to the sustainable urban future

Cities are definable structures with an evolutionary history that can be traced back at least nine thousand years. Wirth (1938) defined the city as "a relatively large, dense, and permanent settlement of socially heterogeneous individuals"[2] For Mumford (1937) it is "a point of maximum concentration for the power and culture of a community". In its complete sense, he wrote, it is:

> ...a theatre of social action, and an aesthetic symbol of collective unity. The city fosters art and is art; the city creates the theatre and *is* the theatre. It is in the city...that man's more purposive activities are focused, and work out, through conflicting and co-operating personalities, events, groups, into more significant culminations. [3]

Before cities existed village life was structured around the affinity of families and neighbours and mostly dedicated to the harvesting of food and the reproduction of life. In contrast with a nomadic lifestyle, the physical enclosure of the village and the social relations within it brought security and common a sense of identity. Order was kept through the council of elders, representing the consensus of wisdom and opinion. Survival and stability depended upon maintaining a sustainable balance between the community and the natural environment and the resources that it had to offer.[4]

There are a number of theories on the origins of cities in which they are presumed to have developed in response to the concept of surplus, i.e., they began when there was a shift away from a simple, self-reliant village economy. The argument goes that surplus production beyond the needs of the community made it possible for some to free themselves from the toil of the land and become specialised in particular tasks, like scribes, craftsmen, priests, and warriors. "Surplus production presumes irrigation, and efficient irrigation systems assume a complex bureaucracy, and that means cities".[5] Others see urban origins in the notion of the city as a protected marketplace that required agricultural intensification to sustain it[6] or as a holy place in need of a ceremonial centre. For some cities were agents of defence and domination evolving as mechanism's by which a society's rulers could establish administrative and military centres to "consolidate and maintain their power".[7] For Sjoberg,(1960) pre-industrial urban growth had more to do with military conquest and political stability than trade. Wheatley (1963) contrasts

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[2] L. Wirth, 'Urbanism As a Way of Life', in *American Journal of Sociology* xliv (1), (University of Chicago Press, July 1938)
[3] L. Mumford, 'What is a City?', in *Architectural Record,* lxxxii (McGraw-Hill, November, 1937)
[4] L. Mumford, *The City in History* (Pelegrine Books, London, 1961)
[5] S. Kostof, *The City Shaped* (Thames and Hudson Ltd,. London, 1991), p. 31
[6] Jacobs, (1984)
[7] G. Sjoberg, *The Preindustrial City* (London, 1960), pp. 67-8

this view of urban imposition by an established political authority, seeing the process as much more internally driven "as a result of the spontaneous readjustment of social, political and economic relationships within the context of folk society".[8]

It is unlikely that a single cause will ever be identified in the complex web of social, economic and political changes, which resulted in the emergence of urban forms. What has become clear is that their beginnings signalled both the transformation of the 'natural' environment and the mutation of the human species from hunter-gatherers and peasants into, what Raymond Williams identified as "a new kind of civilisation".[9] Within the next few years humanity will be a predominantly urban species. Williams argues that the emergent roots of this new form of civilisation can be traced to mid-nineteenth century England, and specifically to that moment during the Industrial Revolution when the urban gained irrevocable ascendancy over the rural, the first time in human history that this had ever been so anywhere. For him the date has "unforgettable significance".[10]

These transformations have been 'achieved' through the application of accumulated scientific and technological advances and yet today many people believe that there are no technological solutions to the environmental crisis. As the ecological limits of urban growth become increasingly apparent and the notion of the scarcity of resources becomes more widely accepted, questions of urban sustainability are falling into sharper focus. Can an urbanised world be ecologically viable? Is the move to full urbanisation a sign of humanity fulfilling its destiny or are we entering the 'end game' - the final stage in decline toward chaos and collapse? Or will we be able to, as Paolo Soleri suggests, transform the urban condition, and in so doing, turn society and the natural environment away from ecological demise.

Although twentieth century urban theorists like Patrick Geddes and Lewis Mumford, and more recently Christopher Alexander and Jane Jacobs have emphasised, not only how a cities might be better shaped physically but also what could improve people's lived experience of them, the emerging planning profession over the years have chosen to focus mainly the material aspects of these ideas and have tended to disregard the psychological effects. Correspondingly they have broken the problems down into their component parts and provided a physical solution. This approach has led planners to introduce ideas of zoning (separating dirty industry from housing), of grid street patterns (to ease mobility) and height restrictions (to protect

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[8] P. Wheatley, cited in S. Kostof, *The City Shaped* (Thames and Hudson Ltd,. London, 1991), p. 33
[9] Raymond Williams, *The Country and the City* (The Hogarth Press, London, 1973)
[10] *Ibid*

skylines) and encouraged by the garden city movement, have tried to bring aspects of the country into the city.

This approach has long been part of the dominant intellectual tradition, which has shaped urban policies throughout modern history and is profoundly rooted in a belief in the virtues of instrumental, rational and analytical thinking. Indeed, in respect of planning, sewage, water, utilities, roads, these approaches have helped to transform chaotic, disease ridden cities into safe and healthy environments. But reason, grounded in science, governed by logic, has its limits too. Today the built environment in the developed world results in damaging effects on the wider environment, both globally and locally. Such "negative external effects" stem from the structure of our modern urban settlements, the ways in which resources are used to construct and service them, and the lifestyles that they shape.

Today, when we consider the immense problems now facing the emerging mega-cities in nations in Africa, Asia and Latin America we can put into perspective the remarkable achievements of Western cities in overcoming the basic problems of urban living through the process of planning and design. But it is equally clear that the late twentieth century model of urban development, characterised by the cities of the industrialised Western world, if repeated globally, would bring ecological collapse.

Much, of course, depends upon the future demographics of the global population and how the process of world urbanisation develops. As mentioned earlier, the UN Population Division estimates that rapid population growth will gradually slow down before reaching 10 billion around the middle of the twenty-first century. Eventually it could level off at around 12 billion at some point in the twenty-second century.[11] Over the last 50 years to population of the world's cities has soared from 200 million to almost 3 billion.[12] The future for the majority of people in the world will be an urban one. Kingsley Davis (1965) predicted an "end to urbanisation" but not necessarily to absolute population growth, economic development, the physical size of cities, or the total number of people they might contain. He suggested that this "end" would be "more apparent than real" since, as countries ascend the attenuated 'S' curve of urbanisation an increasing number of urbanites simply become suburbanised and the boundaries of urban places simply become enlarged. He saw that as a society becomes advanced enough to be highly urbanised the whole "concept of urbanisation becomes ambiguous"[13] and less developed countries eventually become unable to sustain their populations.

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[11] UNPD, (1998)
[12] UNPD, (1995)
[13] Davis, (1965)

As the global population continues to expand, cities will either be the locus of our ecological nemesis or the source of our salvation. Today many people accept that the city represents a legitimate and immense problem and that action is now needed to address the acute crisis of urbanisation and urban environmental degradation. While academics and urban theorists from various disciplines, along with policy makers and politicians throughout the world, have in recent years been debating ways to address these problems very few serious alternatives to the apparent logic of two-dimensional urban expansion, exemplified in cities like Phoenix, Los Angeles, Mexico City, Sao Paolo, and London, have been offered.

It is still unclear in which direction our society must go in order to begin the twenty-first century with a better environment. While it has become apparent that "there will be no sustainable world without sustainable cities"[14], more than a decade after the United Nations Centre for Human Settlements (Habitat) launched its *Sustainable Cities Programme,* we still have no conception of what sustainable cities of the future might look like, how they might be planned, structured, or designed. The sustainability imperative has now attained the sort of political priority status that demands a planned response based on solid theoretical foundations as well as hard technical evidence. There is an increasing realisation that significant obstacles must be overcome before environmental problems can become manageable and an ecologically sustainable society can be brought within our grasp. It is proving extremely difficult to initiate sufficiently broad and in-depth debate, in which accepted orthodoxy such as continuing economic growth, industrial development, and the current patterns of urban growth can be questioned and alternative visions taken seriously. There is a blatant lack of new ideas concerning the future of society. Robert Fishman (1977) recognises the same poverty within the visionary tradition in urban planning after Howard, Wright and Le Corbusier.[15] The question arises; who will create the environmentally responsible society of the future?

8.2 Urban narratives of the twentieth century avant-garde

Paolo Soleri joins those from the nineteenth century, including Ruskin, Blake, and Wordsworth, who were critical of the degradation and despoliation of the environment by industrial production and industrial capitalism. But, in arguing that most of the problems that afflict modern society are a direct consequence of the sprawling pattern of twentieth century urban growth, he also adds his name to those who have voiced concerns about the quality of life

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[14] H. Girardet, *Creating Sustainable Cities,* (1999)
[15] R. Fishman, *Urban Utopias of the Twentieth Century: Ebenezer Howard, Frank Lloyd Wright and Le Corbusier* (Basic Boos, New York, 1977)

in the modern metropolis and echoed many of the real fears and ambiguities that have surrounded the notion of the city during the twentieth century. His critique of the current patterns of urbanisation is echoed in much of the work of contemporary urban theorists, such as David Harvey, Manuel Castells, Doreen Massey, and Robert Beauregard. His desire to come up with a workable alternative is shared by many urban designers and planners, including Peter Calthorpe, Andres Duany and Elizabeth Plater-Zyberk, Herbert Girardet, Richard Register, Richard Rogers, and the Urban Villages Group. And his desire to see widespread social change is being expressed by an increasing number of government organisations and NGOs (WHO, 1987; Brundtland, 1987; Commission of European Communities, 1990; OECD, 1990; UN [Habitat], 1990; ICLEI, 1991; World Urban Forum, 1992; UNCED, 1992). What distinguishes Soleri is his radical approach to solving these problems, the sheer scale of his vision, the philosophical foundation of his urban model, and his determination, since 1970, to test his hypothesis by building a prototype at Arcosanti. Soleri calls for nothing less than the complete transformation of the spatial and physical configuration of the modern city into "three-dimensional" structures. The core of his argument is that:

> In order to support all the complex social and economic activities that sustain human culture, and to give it a new perception and renewed trust in society and its future, the city structure must contract and miniaturize into dense, integrated, three-dimensional structures.[16]

In abandoning traditional architectural practice and focusing on the projection of a different way of thinking about buildings Soleri joins a long list of visionary architects that includes Piranesi, Boullée and Ledoux, from the eighteenth century. His theoretical work also follows in the tradition of other futuristic urban narratives of the twentieth century avant-garde. Like Howard, Garnier, Le Corbusier, and Wright, Soleri has tried to rethink and re-plan the twentieth century industrial city from its infrastructure upwards.

And as in other urban narratives of the twentieth century avant garde; like Antonio Sant'Elia's *Città Nuova* (1914); Fritz Lang's expressionist metaphor in *Metropolis* (1929); Iakov Cherrnikhov's Constructivist *Architectural Fictions* (1933); Yona Freidman's *Spatial City* (1958); Kiyonari Kikutake's *Marine City* (1958); Buckminster Fuller's *Geodesic Dome for Manhattan Island* (1962); Arata Isozaki's *Modern City* (1963); the Archigram Group, Peter Cook's *Plug-in City* (1964) and Ron Herron's *Walking City* (1964), Ridley Scott's post-apocalyptic urban scenario in *Blade Runner* (1982), Soleri's designs have had the power both to excite and disturb their reviewers.

8.2.1 Garden city

At the end of the nineteenth century in *Tomorrow: A Peaceful Path to Real Reform* (1898)[17], Ebenezer Howard (1850-1928), stated that an extensive reconstruction of the environment was necessary in order to resolve the seemingly endless process of rural/urban migration which had led to a lack of labour in the countryside and overcrowded urban areas characterised by mass unemployment, poverty, insecurity, crime, unsanitary conditions and pollution.[18] Influenced by Ruskin's Romantic notions of social reform and Morris's anarcho-communist ideals [5.3.3]. Howard set out to resolve the migration problem and counter the trend toward urbanisation. Because he believed that neither the city nor the country could satisfy all human needs, his solution was a form of revolutionary city planning, wherein new cities would be designed and built which were also lush gardens (or gardens would be designed and created which were also cities).

The attractive qualities within both the country and the city were to be harmonised within what he termed a new "town-country" magnet. Incorporating an extensive public transportation system, clean industry and electricity, spacious green zones, re-use of waste materials, and the intentional integration of living, working and recreational areas, his garden cities offered conditions intended to stimulate environmentally benign behaviour, thus ensuring that the environment became an integral part of society. His theories, influenced by Edward Bellamy's Utopian novel *Looking Backward 2000-1887* (1888) which predicts the transformation of human society, through environmental revolution and the demise of economic competition, constitute a decentralised ecological approach to town planning. To test his ideas he put forward a scheme to build a small model city.

'Garden City' was to be built on the central 1,000 acres of a 6,000acre estate, and have a population of 32,000. The town was circular in plan and was surrounded by farms, small-holdings, allotments and woodland on the remaining 5,000 acres. Also located within the "green belt" were brickfields, institutes for the blind and deaf, convalescent home, industrial schools and an agricultural college. The town's industry was positioned on the perimeter serviced by a circular railway looped-up from the main railway line. Electricity would power the industry and keep pollution hazards to a minimum. The architecture was to be varied to allow for the widest possible individual taste and preference.

[16] P. Soleri, *Arcosanti Workshop Program Brochure* (Cosanti Foundation, Scottsdale, 1987), p. 1
[17] Later re-issued with some changes of emphasis as *Garden Cities of To-morrow* (1902)
[18] E. Howard, *Garden Cities of To-morrow* (1902), (Attic Books, Eastbourne, 1985), p. 6

Six radial boulevards divided the town into six wards of equal size. In the centre was a small garden of five acres. Fronting onto this, with the Central Park at their backs, were the public buildings like the town hall, hospital, library, museum, and art gallery. The central park was surrounded by a glass shopping arcade that Howard called "Crystal Palace". Five circular avenues divided the town with the third, Grand Avenue, being 126 metres wide, complete with parkland, schools. Churches, and recreational areas.

Houses set in their individual gardens fronted onto the avenues and boulevards, and were planned at a density of about 20 houses to the acre. Raymond Unwin (1863-1940) would subsequently reduce this figure to 12 houses per acre when the first garden city was finally planned and built at Letchworth (1903). These figures were lower than the average at the time although higher than many contemporary suburbs. The wards were wedges of a circle which were a microcosm of the whole town, housing almost self-contained communities of 5,000 people - the conceptual forerunner of the neighbourhood units of contemporary planning.

In Garden City Howard believed that the town and the country would co-exist happily and be mutually dependent. The physical dimension of the town would be permanently limited and the agricultural belt would be left undeveloped. Citizens mostly working in the industries would be close to the countryside, while the rural community, working mostly in agriculture, would have the benefits of proximity with the town and could share in its social and cultural life. Howard's precise formulation of ecological preconditions was intended to maintain self-sufficiency while guiding industrial activities and a large portion of the policy-making choices. Environmental considerations were, in this way, fully immersed in planning and social structures. The environment thus formed a foundation for architectural and social planning. Despite his overemphasis on the unity of design and his underestimation of the ecological benefits of urban life, Howard's vision, which was realised as a developmental strategy at the Garden Cities of Letchworth and Welwyn (1920), was able to address the complex and connected issues of urbanisation, industrialisation, environmental degradation and pollution, in a structured and holistic way. City planners, social reformers and architects from around the world have since drawn inspiration from his theories and, filtered through Patrick Geddes (1834-1932) and the nineteenth century French geographers, Elisée Reclus and Vidal de la Blache,[19] they led to the development of regional planning and the New Town programme that emerged after the Second World War.

Patrick Geddes, and subsequent followers, Patrick Abercrombie and Lewis Mumford, were proponents of regional scale planning which attempted to place more importance on the regional

approach by placing them in a wider economic, social and physical context. This led to the idea of the civic or regional survey, and to planning at a city region scale. Overall the regionalist approach was to accept the inevitability of the forces of outward drift and to plan for it accordingly.

8.2.2 Futurist city

> Now the giant city sucks the country dry, insatiably and incessantly demanding and devouring fresh streams of men till it wearies and dies in the midst of an almost uninhabited waste of country.[20]

Futurism was a poetic current before it became a movement in painting and sculpture. The 'Foundation Manifesto of Futurism' published in *Le Figaro* in 1909 was created by the poet Tommaso Filippo Marinetti who attacked traditionalism, and upheld an expression nourished by contemporary forces and the new industrial environment. The modern metropolis, seen as the typical expression of the forces of society, was the typical subject matter of the movement although there was not a 'Futurist Architecture' as such. There was though an architecture manifesto attributed to Antonio Sant'Elia (1888-1916) although it is widely accepted that it is largely Marinetti's responsibility. In its first version, known as the *Messaggio* (1914) it accompanied an exhibition of Sant'Elia's carefully rendered presentation drawings for the 'Città Nuova' along with his vision of Milan in the year 2000.

> We must invent and rebuild *ex novo* our modern city like an immense and tumultuous shipyard, active, mobile and everywhere dynamic, and the modern building like a gigantic machine...The house of cement, iron and glass...as big as need dictates, and not merely as zoning laws permit, must rise from the brink of the tumultuous abyss; the street which , itself, will no longer lie like a doormat at the level of the thresholds but plunge storeys deep into the earth, gathering up the traffic of the metropolis connected for necessary transfers to metal catwalks and high-speed conveyor belts.[21]

There was no overall plan for Sant'Elia's city. It was more a collection of new building types and suggested ideas for power stations, airports, airport hangars, multi-level stations and stepped apartment buildings of a type called *Casa a Gradinate.* 'Città Nuova' was reputedly inspired by his earlier proposal to rebuild Milan Central Station (1906)[22], which was based on a complex network of transport services, seven levels deep in places. Out of this "three-dimensional grid of

[19] H. Meller, *Patrick Geddes: Social Evolutionist and City Planner* (Routledge, London, 1993)
[20] O. Spengler, *Decline of the West* (George Allen and Unwin, London 1926), p. 102
[21] Sant'Elia, *Messaggio* (1914) a preface to the exhibition of 'Città Nuova'. The entire text is cited in R. Banham, *Theory and Design in the First Machine Age* (Architectural Press, Oxford, 1960), pp. 128-30
[22] R. Banham, *Theory and Design in the First Machine Age* (Architectural Press, Oxford, 1960), p. 132

communications"[23] arose huge *gradinate* structures, usually of buildings with floors of equal depths that stepped back progressively toward the top. The overhangs at the rear were matched with the building's twin, which backed up against it, leaving an archway through which transport and services passed. Lift shafts were positioned on the façades and rising vertically required connecting bridges at the upper levels.

Although there precedents for the formal design of the blocks in Henri Sauvage's set-back apartments built in Rue Vavin, in Paris (1912), in the dramatic forms of nineteenth century warehouses, and bridges and in the lifts on the shores of Lake Como, "rising from landing stages, and connected back to points on the mountainside by bridges"[24], Sant'Elia's concept of the multi-layered tower city, presented like a "colossal dynamic mechanism"[25] is just as likely to have been inspired by early images of Manhattan with its elevated railways and skyscrapers.

Futurism's central assumption was that the spirit of the age was inevitably tied to the evolution of mechanisation and that modern architecture must take this into account in its function, its methods of construction, its aesthetics, and its symbolic form. With the celebration of modern materials allied to an indulgence in mechanical references it drew together a collection of progressive attitudes and future-orientated positions that influenced the subsequent utopian projects of Garnier's *Une Cité industrielle*, Le Corbusier's *La Ville Radieuse*, and Soleri's *Arcologies*.

8.2.3 Industrial city

In 1917 Tony Garnier (1869-1948) published a less radical contribution to contemporary urbanism in *Une Cité industrielle* (1917) which demonstrated his belief that the cities of the future would have to be based around industry.[26] Garnier's industrial city was designed for 35,000 inhabitants, as a regional centre of medium size, to be planned in a sensitive relationship with its surrounding environment. Without walls, private property, churches, barracks, police stations, or law courts, all the unbuilt areas were to be left as public parkland. In accordance with a strict set of planning codes, aimed at maximising the provision of light, ventilation and green spaces Garnier established a housing typology, resulting in low-density housing at an average of two storeys in height, distributed along a hierarchy of tree-lined streets of varying widths. Anticipating the principles of zoning separation advocated by the Congrès Internationaux d'Architecture Moderne (CIAM) *Athens Charter* of 1933, Garnier's industrial city was based on

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[23] *Ibid*, p. 133
[24] *Ibid*
[25] W. J. R. Curtis, *Modern Architecture since 1909* (Phaidon Press, London, 1987), p. 74

distinct zoning for residential, industrial, transport, and health areas. At the first meeting of the CIAM (1928) Walter Gropius and Le Corbusier had argued that architecture should be put "back in its true sphere which is economic, sociological, and altogether at the service of humanity".[27] By 1933 the doctrines of the *Athens Charter*, which would later appear in José Luis Sert's *Can Our Cities Survive?* (1942), were firmly fixed on the problems of the modern city:

> Today most cities are in a state of total chaos. These cities do not come anywhere near achieving their aim, which is to satisfy the biological and psychological needs of their inhabitants...On a spiritual and material level, the city should ensure individual freedom and the benefits of collective action.[28]

Above all else Garnier's industrial city was the vision of a socialist arcadia where the public buildings, including a museum, library, theatre, swimming pool were to be grouped around the axis of an assembly complex, complete with a cluster of union meeting rooms and a central circular 3,000-seat auditorium flanked by smaller amphitheatres. As Frampton (1980) points out the various democratic gatherings would have taken place beneath the massive railway station clock-tower with its entablature inscribed with two quotations, one from Saint-Simon about achieving "international harmony through industrial production and communication", and the other from Zola's *Travail:*

> This was the incessant production suitable for epochs of peace, rails and yet more rails, so that all frontiers might be passed over, and so that all peoples, reunited, might form a single people, on an earth entirely furrowed by routes. These were the great steel ships, no longer the abominable ships of war carrying devastation and death, but ships of solidarity and fraternity, exchanging the products of continents, increasing the domestic riches of humanity tenfold, to that point when tremendous abundance reigned throughout.[29]

Garnier's plans draw on French urban formalism in its use of axes, on Howard's decentralised ecological ideals, on principles from the utopian-socialist tradition, and proposed the use of new construction methods using reinforced-concrete being pioneered in Paris by Auguste Perret (1874-1954). Although Garnier's plans conserved the "old city" it also offered a compelling model for an emerging machine-age society and among others it influenced Charles Edouard Jeanneret, later to become Le Corbusier.

[26] T. Garnier, *Une Cité industrielle: Etude pour la construction des villes* (Paris, 1917, 2nd edition 1932)
[27] CIAM, 'Declaration of Aims' (La Sarraz, Switzerland, 1928)cited in W. J. R. Curtis, *Modern Architecture* (1987), p. 171
[28] J. L. Sert, *Can Our Cities Survive?,* (Harvard University Press, Cambridge, MA., 1942)
[29] A quotation from Zola's *Travail*, alluding to the ritualistic celebration of a utopian harvest cited in K. Frampton, *Modern Architecture* (1980), p. 102-3

8.2.4 Radiant city

> The machinery of Society, profoundly out of gear, oscillates between an amelioration, of historical importance, and catastrophe. The primordial instinct of every human being is to assure himself of shelter...It is a question of building which is at the root of the social unrest of today...The problem is one of adaption, in which the realities of our life are in question. Society is filled with a violent desire for something which it may obtain or may not. Everything lies in that: everything depends on the effort made and the attention paid to these alarming symptoms. Architecture or Revolution.[30]

Le Corbusier (1887-1969) believed that it was the business of architects and planners to give form to the new society and thereby avoid an imminent revolution. He perceived the same problems of the industrial city as Howard and Wright but his own radical solution, demonstrated in the late 1920s and early 30s in his ideal city plans, was to increase rather than reduce urban densities, "to decongest the centres of cities by increasing their density".[31] In the late nineteenth century Camillo Sitte (1843-1903) had argued for urban planning to resurrect the activity and intensity of the medieval or Renaissance urban core and became the unintentional guiding light for many twentieth century urban centrists. Le Corbusier, an early enthuisiast for Sitte's ideals, designed *La Ville Radieuse* (1933) ('the radiant city') as a centralised and densely populated collectivist city, laid out in a rigidly symmetrical grid pattern quite unlike Sitte's towns. Based on his earlier urban models of *La Ville Contemporaine* (1922), and the reworked version superimposed on the Right Bank of Paris, *La Ville Voisin* (1925), the *radiant* city was designed according to Le Corbusier's belief that within an environment of strict geometric order, the human mind would be uncluttered, and hence 'calm'. He believed that the home should be a place of silence and solitude, a place in which to meditate and be creative. But in order to develop this the home had to adopt an entirely new character and this, in turn, necessitated a complete re-arrangement of the urban fabric , a new arrangement of transport, new concepts of space and techniques of building construction. Because he understood that proximity to nature was a stimulus to meditate and introspection, Le Corbusier advocated the concept of the Vertical Garden City combining the high density of the metropolis with Howard's Green ideals. The mass of a building, he suggested, rather than be strung out along the edge of a site with accommodation arranged around a central courtyard, should be re-configured into one tall structure in the centre of the site. The ground plane could then be opened up for pedestrian use, for transport, and natural landscaping, and could allow the ingress of light and air into the structure.

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[30] Le Corbusier, *Towards a New Architecture* (1923) in J. Rodker (transl.), (Architectural Press, Oxford, 1989), p. 8 and pp. 288-9
[31] P. Hall, *Cities of Tomorrow* (Basil Blackwell, Oxford, 1988), p. 207

In *La Ville Contemporaine*, a "contemporary city of three million inhabitants", the city's core of twenty-four 60-storey cruciform "Cartesian" office skyscrapers, was surrounded by twelve storey high-density residential blocks set within a park that extended to an area four times the size of Manhattan. All the buildings were to be raised clear of the ground on *pilotis*, including garages and roads, leaving the surface free in the form of a continuous park through which pedestrians could wander at their leisure. Broad roads were designed to allow the rapid flow of traffic to and from the countryside and to connect different parts of the city. The traditional notion of the 'corridor-street' was destroyed. Instead of the polluted industrial city a new clean and efficient world of light, air, and greenery was to be created within a reintegration of the country and the city. To convey an idea of how the 'contemporary city' might look and the notion that this was a future that was attainable in the present Le Corbusier fused images of Manhattan with those of Sant'Elia's *Città Nuova* (1914).[32]

Although it contained many of the same elements as his earlier plans, Le Corbusier's *La Ville Radieuse* (with a planned population of 1.5 million), like Garnier's Cité Industrielle and the linear-city concept proposed by Milyutin, was zoned along parallel bands assigned to various uses; from the isolated offices in skyscrapers at the "head" of the city via the cultural "heart", located between the two "lungs" of the residential zone in the middle, to the warehouses and industry at the base.[33] This less centralised model allowed the city to be theoretically expandable. Le Corbusier's plan for the industrial city of Zlín (1935), then Czechoslovakia, designed for the shoe manufacturer Bata, was an adaption of the model to a specific site, linking the old town and manufacturing centre at the base of the valley with an airport on the plateau above. In the Zlín plan the industry buildings are located on one side of the road and railway line running through the valley, with the housing units positioned on the opposite, south-facing slope of the hill. The Radiant City was an influential model for post-war urban development in Europe. Depending on which method of analysis is adopted the residential density of the proposed city ranges between 1000 and 3,500 people per hectare.[34] In Britain a stream of proposals for high-rise blocks, based on Corbusian ideals were designed and implemented in the 1950s and 60s. Two new capitals were indebted to the ideas it embodied, at Chandigarh, capital of the Punjab (masterplanned by Le Corbusier in 1950) and Brasilia in Brazil (planned by Lucio Costa in 1957).

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[32] Curtis, (1987), p. 165

[33] N. A. Milyutin, *Sotsgorod: The Problem of Building Socialist Cities* (1930), (MIT Press, Cambridge, Mass., 1974)

[34] J. Dunnett, 'Future Cities: contemplative or delirious?' in *The Architects' Journal* 212 (1), (July 2000), pp. 20-1

TABLE 8.1

A CHRONOLOGY OF SELECTED CENTRIST AND DECENTRIST URBAN PROPOSALS
Including Key Projects by Paolo Soleri

	Centrists		Decentrists	
	Project	**Protagonist**	**Project**	**Protagonist**
1800			New Lanark	Robert Owen
1850			Saltaire	Titus Salt
			Bournville	George Cadbury
			Port Sunlight	William Lever
1900			Garden Cities movement	Ebenezer Howard
1915	Città Nuova	Sant'Elia	Regional planning	Patrick Geddes
1930	Ville Radieuse	Le Corbusier		
1935			Broadacre City	Frank Lloyd Wright
1955	*Cosanti*	*Paolo Soleri*	New towns movement	Lewis Mumford
1960	Urban diversity	Jane Jacobs Richard Sennett		
	Mesa City	*Paolo Soleri*		
1970	*Arcology*		Ecumenopoly	Constantin Doxiadis
	Arcosanti	*Paolo Soleri*		
1975	Compact city	Dantzig and Saaty		
	Two Suns Arcology	*Paolo Soleri*		
1980	*Habitats for Shifting Populations*	*Paolo Soleri*		
1985	*Space for Peace*	*Paolo Soleri*		
1990	Compact city	European Commission National governments	Market solutions	Gordon & Richardson
	Circular metabolism	Herbert Girardet	'Good life'	Robertson, Green & Holliday
1995	Sustainable city	Richard Rogers		
	Hyper Building	*Paolo Soleri*		

Source: various

As in Renaissance ideal cities like Filarete's Sforzinda (1457-64) or Palmanova (1593-1623), the utopian socialist diagrams of, for example, Claude Nicolas Ledoux at Chaux (1775) and Robert Owen's 'Project for a Village of Co-operation' (1816), and Howard's plan (1889), Le Corbusier's city exhibits a concern for geometric purity and the establishment of social order through clarity and symmetry. The Renaissance idea of the Humanist city, where perfect form is the image of a perfect society is translated in La Ville Radieuse in the symbolic analogy of the human body, where the city has a spine, a heart, lungs, and a head, thus incorporating the ideal

of twentieth century 'man' in a perfect and harmonious balance with nature. This Humanist anthropomorphic metaphor was to be adopted by Soleri in his *Mesa City* project from 1958.

8.2.5 Broadacre city

In the 1920s and 1930s Frank Lloyd Wright called for a radical transformation of American society which would restore the traditional Emersonian ("love of wilderness") and Jeffersonian (pioneering "struggle for independence") sentiments. In *Broadacre City* (1934 - 1958), the embodiment of his vision, every citizen of the United States was be given a minimum of one acre of rural land per person. The independent family homestead was to be the basis for a decentralised American society, which would re-inhabit the rural landscape with restored virtues of 'freedom' and 'self-reliance'. Unlike Kropotkin's communes, based on the Russian *mir* and founded on the principle of mutual aid (1902), in Broadacre City family stability was to be augmented in relative isolation. A sense of community was to be achieved principally through telecommunications and transportation.

Wright seems, in many ways, simply to have been accepting the inevitable. In the 1920s the new technologies of the motor car and electricity began to loosen the cities, enabling them to spread into the countryside. Cities have always been places of opportunity and problems, change and crisis. Often the challenges they have thrown up – overcrowding, disease, social disorder, conflicts over land and its uses, a lack of infrastructure – have been tackled in innovative ways. In the period after the Industrial Revolution the challenge was how to respond to immediate problems of the "evils of the nineteenth century city".[35] Physical infrastructures needed to be created - sewage systems to contain disease and improve public health; housing to accommodate ever-expanding populations; roads and railways to increase mobility for people and products. For Ebenezer Howard, Patrick Geddes, Frank Lloyd Wright, Le Corbusier and their followers their primary motive lay in the reaction to the squalor of the towns and cities that were thrown up by the first era of rapid industrialisation.

The Industrial Revolution had already spawned a number of responses in the UK during the nineteenth century in the form of private, philanthropic ventures at New Lanark, Saltaire, Port Sunlight and Bournville. What these enterprises had in common was a desire to create healthy and efficient communities within a pleasant environment, away from the disease and congestion of the industrial city. These social experiments had very little impact on the general process of urban centralisation, which continued throughout Europe until the 1940s.

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[35] P. Hall, (1988), p. 7

Like Ebenezer Howard, Wright was reacting against the industrial city and industrial capitalism. But unlike Howard who favoured regional autonomy through the establishment of local councils, and Le Corbusier who advocated centralised control through the state, Wright wanted individuals to be free to live and work in the countryside and, in Broadacre City he wanted to be the architect of a planned and aesthetically controlled process of decentralisation. But from the 1920s onwards various forces combined to create the massive suburbanisation and uncontrollable urban sprawl that has come to characterise much of the modern built environment.

8.3 Paolo Soleri at Taliesin West

Paolo Soleri was born was born in the industrial part of Turin, Italy, on June 21 1919. In 1933 his family moved to Grenoble in France to escape Mussolini's fascist regime and Soleri attended L'Ecole d'Art Industriel. When, two years later, they returned to Italy, he continued his education at Torino Academia Albertine in the Liceo Artistico. Between 1941 and 1946 he studied at the Turin Polytechnical Institute, where he graduated with highest honours taking a doctorate in architecture, which focused on the subject of 'human ecology'. Within two years he was one his way to the United States as a Fellow of the Frank Lloyd Wright Foundation. After a compulsory month-long stay on Ellis Island he travelled to Taliesin West, outside of Phoenix, Arizona, where, in between working in the kitchen and acting as a personal aid to the Wright family, he undertook research on bridges and passive heating systems.

Soleri's early architectural studies were influenced, like many of his contemporaries in Europe, by the work of Le Corbusier, Mendelsohn, Gropius and Aalto [36] but then "suddenly this little booklet comes out in Italian on Frank Lloyd Wright with a photo of the desert thing. And it threw me".[37] After a brief exchange of letters, he joined an expanding group of post-war foreign apprentices who were then converging on Taliesin to hear at first hand Wright's radical views on the new architecture of American democracy. Many were awarded scholarships and given a 'fair trial at working their way through without fees'.[38]

It was traditional for apprentices around this time to give Wright a gift each year at Christmas and on his birthday. The 'Box', as it was called, contained the students own architectural projects and offered an otherwise rare opportunity to get feedback from the 'master architect' on their

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[36] G. Stanishev. 'Soleri's Laboratory' in *World Architecture* 21 (International Forum of Young Architects, January, 1993), pp. 58-63
[37] T. Ostler, 'Preaching in the Wilderness' in *Building Design* (February 18, 1994), pp. 12-3
[38] B.B. Pfeiffer (ed.), *Frank Lloyd Wright: Letters to Apprentices* (California State University, Fresno, 1982), p. 23

own imaginative terms. He put great emphasis on this event and the comments he made were seen as "the greatest architectural critiques any apprentice would ever receive".[39] Soleri, described by Blake (1969) as one of Wright's 'most brilliant students'[40], made his box contribution with others in the summer of 1948 (see Plates 1 & 2). In his letter of response Wright wrote that:

> Paolo really went to town on his. His passionate rendering had a painter's virtuosity and technique...The plateau he mounted his well conceived building scheme upon was richly decorated by his buildings. But again they seemed to me all *on* the plateau, not *of* it. And there again even in scheme Paolo seemed more the brilliant painter than the Architect. But there are many roads to Architecture and he may find one of them if he is patient enough.[41]

About a year later, Soleri's apprenticeship was abruptly terminated with a polite letter of dismissal from Wright.[42] The young apprentice had not, it seems, been patient enough. He had asked Wright's permission to establish another Taliesin in Italy and, although initially enthusiastic, Wright had become upset to discover that a group of his own apprentices were keen to join Soleri in Europe. When he found out that the young student's design for a bridge had been published in Elizabeth Mock's *The Architecture of Bridges* (1948) alongside his own, and had attracted better reviews, Soleri was on his way out of Taliesin.

Although some argue that his architecture is a 'parody' of Wright's in the sense that his building is an "organic outgrowth of its site"[43] Soleri does not subscribe to being an 'organic architect'. For him Wright's prairie houses represent a "spurious and superficial way of being in sympathy with nature".[44] Soleri did not share Wright's enthusiasm for decentralisation. He writes about environmental collapse and how "suburbia" is a prime culprit. He sees in urban sprawl the symbol of our functional, social and cultural vacuum in the midst of an ecological debacle. Soleri argues that Wright, the spokesman for 'organic architecture', had demonstrated his fundamental hostility towards urbanism in the proposals for Broadacre City. His decentralised view of American society was based on the widest possible use of the motor car and involved, the "general mobilization of the human being". To Soleri the car is, "... the great villain of the century, and quite possibly the great villain of all time...an apocalyptic example of mindless

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[39] *Ibid,* (1982), p. 110
[40] P. Blake, Foreword in *Arcology: City in the Image of Man* (January 1969)
[41] Letter from Wright, July 3, 1948 cited in Pfeiffer, (1982), p. 110
[42] R. Pizarro, 'Soleri's Pendulum: Between Urban Design and Theology' , (Masters thesis, Arizona State University, 1996), p. 108
[43] R. Candida Smith, 'Frank Lloyd Wright as Educator: the Taliesin Fellowship Program, 1932-59' in I. Borden and D. Dunster (eds.) *Architecture and the Sites of History: Interpretations of Buildings and Cities* (Butterworth Architecture, Oxford, 1995), pp. 227-42
[44] Soleri cited in Ostler, (1994), p. 12

logistics and technological slavery".[45] His alternative involves drawing people and their activities back together into dense, complex and integrated three-dimensional structures. His urban model is more in the centrist tradition of Sant'Elia (1914), Garnier (1917) and Le Corbusier (1922), but, like Howard, his approach is firmly ecological.

> There are no real answers in the cities as we have known them...No organism can overcome prolonged starvation, even if it is starvation in the midst of plenty. Every one of its organs becomes segregated in an attempt to survive, and such mutilation brings about their abandonment one by one. The present reduction of metropolitan life to a pure struggle for survival is the reason for the conception of a more apt system...[46]

Today at over eighty years old, Soleri is pursuing the objectives, which have occupied since he left Taliesin West in 1949. He has throughout this time expressed the view that our current patterns of urban development are fundamentally flawed and has dedicated his life to finding a workable alternative to urban sprawl with its detrimental impact on communities and the environment.

Rather than accept the trend of outward drift and the inevitability of decentralisation Paolo Soleri has, since the 1950s, envisaged a re-orientation of city life through a process of *urban implosion,* wherein the city is compacted and intensified, made three-dimensional and pedestrian and designed to conserve the earth's energy and resource. Avoiding the bandwagon of environmental despair and the Arcadian view that by moving into the wilderness we can escape the degradation of the city, his attempt has been to define a truly urban solution which seeks to provide shelter, not just for individuals, or families, but for society as a whole. His response to the discrepancy between the city and the countryside identified by Howard, lies in the relationship between architecture and ecology and in his attempts to seek how the two can come together so that the integrity of the environment is preserved and the quality of life is kept intact:[47]

> Soleri's answer is urban implosion rather than explosion. The city should contract and intensify, but in order to hold its information in negroponic form, it should imitate evolution and complexify itself through intense miniaturization. A city of 600,000 should become a single recycling organic arcology. The people would not live crowded in ghettos but on the outer skin of a towering arcology that faced toward a nature that was once again natural. Thus the surface of an arcology would be a "membrane and not a wall". Inside the arcology, along its central spine axis, would be not the natural but the civic space. Here society would turn inward for the concerns of man and culture.[48]

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[45] P. Soleri, *The Bridge Between matter and Spirit is Matter Becoming Spirit* (Anchor Press/Doubleday, Garden City, NY, 1973), p. 164
[46] Soleri. *Arcology,* (1969), p. 8
[47] H. Skolimowski, 'Paolo Soleri: the Philosophy of Urban Life' in *aaq* 3 (1), (1971), pp. 134-42
[48] W. I. Thompson, *Passages about Earth* (Harper & Row, New York,1973), pp. 35-36

Although he was critical of his urban theory, Soleri was inspired by Wright's organic philosophy of architecture, and equally impressed by the integrated community life that was the basis of Taliesin's Fellowship. The experience would have a strong influence in how the workshop program at Arcosanti was later structured. But there were few thoughts on arcology during his spell with Wright.

> ...when I was at Taliesin I wasn't thinking about arcologies and all those things. I was just absorbing and doing the little things I was asked to do. I was very grateful to have that experience and it was very important to me.[49]

8.4 Ecumenopoly versus arcology

Among the most useful urban utopias of recent years are the radically different visions of Constantin Doxiadis (1913-75) and Paolo Soleri. Doxiadis applied his theory of "ekistics", his "science of human settlements", to the existing trends that he identified in world wide population growth, and urban development patterns, and proclaimed his vision of the urban future, which he called *Ecumenopolis* (1969).[50] Doxiadis argues that five basic elements of Nature, Man, Society, Shells, and Networks together form a system of human settlement which ensure our continued happiness and safety within Ecumenopolis. He argued that the major "trends of present technological and economic progress cannot and should not be reversed" and that problems that have traditionally concerned urban theorists and designers - such as poverty, overcrowding, environmental degradation, social conflict - were no more than distractions. He branded the visions of others - including eliminating the car, colonising space, back-to-nature ideas, the creation of megastructures, and the establishment of new towns, as "escapist solutions" and argued that "the most probable, logical and practical solution...is the progressive expansion of the present type of city as a result of the massive influx of an ever-increasing population". Ecumenopolis was described as emerging "universal system of life" and single "global settlement".

In attempting to balance, what he saw as a historical human need to live in small-scale communities with the inevitability of urban sprawl, he proposed a global city of twenty billion inhabitants spread out along the seaboards of the major continents and organised into semi-autonomous communal "cells", each sustaining a population of 40,000. Others have described the kind of conurbation to which he refers as "megalopolis". Lewis Mumford described it as

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[49] Soleri cited in Mayne, *Soleri's Cities: Architecture for the Planet Earth and Beyond* (1993)
[50] C. Doxiadis, 'Ecumenopolis: World City of Tomorrow', in *Impact of Science on Society* (UNESCO, Volume xix, No. 2, 1969)

"urban pathology" and "sprawling gigantism". To Soleri (1969) ecumenopoly presents a frightening "map of despair":

> The thinking is that of a creature bound to a surface existence. *He has been given a surface enveloping a solid sphere, and he is doing his level best to carpet it with one or two or five layers of performace. It will not do.* [original emphasis][51]

Soleri looks at the same emerging realities and takes human society in an entirely different direction, drawing the elements back together towards a revolutionary new kind of human environment, a "neonature", arranged within 'giant' *arcologies* some containing populations of millions leaving the rest of nature to develop on its own terms (see Plate 3).

Having spent most of his working life trying to find ways in which the combined processes of architecture and ecology can move towards a better form of urban life, and following Teilhard de Chardin, Soleri argues that "life in general and human life in particular can be symbolised by a vector and...not by a random pattern".[52] He says that we humans are both the 'means' and the 'ends' in a process in which the direction of human energy, and what we call time and we know as history is towards a conclusion.[53] Arne Naess has put it another way. He says that we humans are "something essentially on the way". Rather than seek perfection, Soleri has been trying to clarify some of the basic processes by which human life and human societies have evolved, and apply these concepts in producing of a different kind of architecture, one which he says is historically valid and based on sound ecological principles. He says it is, "simply part of the nuts and bolts pragmatism of matter becoming spirit".[54]

8.5 The arcology theory

As described earlier a number of models have recently been proposed to respond to local and global environmental problems highlighted in both the green and brown agendas. The compact city idea is now being promoted as a major component of the various strategies emerging to tackle some of these problems. The rationale for its implementation lies in a set of strategic benefits that are seen as the outcome of more compact urban forms in which travel distances are reduced lessening fuel emissions, rural land is saved from development, local facilities are supported and local areas become more autonomous. Despite reservations that

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[51] Soleri, *Arcology* (1969), p. 2
[52] *Ibid*, p. 1
[53] Following De Chardin's idea of organic unity at 'point Omega' Soleri's eschatological hypothesis describes the 'Omega seed' as a conclusion in a process of 'esthetogenesis' in which all matter, the physical world will finally be transcended into pure spirit. Accordingly all parameters: mass, energy, time and space are instrumental and therefore sacred

many of these benefits are far from certain, the concept is being held up as the way forward and, policies which promote urban compaction are being promoted by Western politicians, eager to deliver major environmental improvements.

Many more people are willing to accept that, in large part, the environmental crisis is caused by the way our cities are designed and built. But few have been working towards serious alternatives. Paolo Soleri is an exception.

> ...[He] has thought deeply about what is wrong with our civilization, what renders it unsustainable. He has envisioned a redirection of the organization of urban life which would not only ensure that we have a futurebut also make it likely that that future would move towards the consummation of the human adventure rather than obliteration.[55]

Since 1970 the "urban laboratory" in Arcosanti, Arizona , under his direction has been conducting experiments in the radical reorganization of the sprawling urban landscape into dense, integrated, three-dimensional cities. Upholding the traditional medieval model of containment the *arcology theory,* which underpins this approach, is directed towards the optimal performance of the human habitat and the definition of a new type of urban "instrument" that aims at maximising, what he calls, the *urban effect* via a process of *complexity* and *miniaturisation.*[56] (see Plate 4). Soleri describes the "urban effect" as "that fundamental phenomenon in which two or more particles of 'physical matter' interact in ways other than statistical and fatal. That is to say, in ways which are organic or living and eventually the 'instinctive', conscious, self-conscious, mental, cultural, spiritual ways".[57] Cities are essential to humanity's continued evolution because they are the "crucibles of [a] complexifying process at the collective level of consciousness". He believes that an urban environment that enhances and encourages human interaction is bound to raise humanity's collective consciousness. "It's very clear that life is not an explosion of things , but an implosion".[58]

As a model derived from biological principles arcology merges the discipline of architecture with the science of ecology in an attempt to define a habitat which is more efficient and economic than the current pattern of urban development on the basis that:

[54] Soleri, *The Bridge Between Matter and Spirit* (1973)
[55] J. Cobb, 'Comments on Arcosanti: An Urban Laboratory?' in Soleri, (1983), p. 12
[56] The urban effect is described as a universal effect involving the transformation of mineral matter into mind via the potentially unlimited power of complexification and minaturization.
[57] P. Soleri, *Technology and Cosmogenesis* (Paragon House, New York, 1985), p. 51
[58] P. Soleri cited in J. Monczunski, 'Arcosanti, a Habitat for Humanity' in *Notre Dame magazine* (Winter 1998-99)

> The better use you can make of what's available the better the situation is going to be. Since arcologies...fundamentally would deliver more for the buck, or for the amount of material or energy used, then it is quite evident that as an instrument it would be a positive one.[59]

8.5.1 The complexity-miniaturization-duration paradigm

In the critical part Soleri asks us first to consider that the best hopes for humanity have been fulfilled. We are to assume that in time human skills have cleared the urban environment of slums and cleansed it of all its problems and grievances. "Equity is thus granted...We then have happy man in a full fledged co-ordination of city and urban expanse. Megalopoly stretches over continents...emerging victorious and shiny above an unending suburbia".[60] The critical end of his work is to expose this condition as a double dose of false hope; false because it's utopian and false because it is fatal, "a scourge far greater than the squalor of the present".[61] Teilhard de Chardin wrote that "Man is the ascending arrow of the great biological synthesis".[62] In megalopoly and suburbia Soleri sees the disowning of any conscious urge that might exist in us to evolve and a settlement for something less absorbing. He describes suburban sprawl as a 'flight to boredom', a kind of "giving up", he says, "in the calm sea of affluence".[63]

> Suburbia doesn't work because it is endless matter which is flat and amorphic. It promises so much but gives so little. Life's bulk is negated when megalopoly and suburbia become the environmental bulk.[64]

Soleri argues that for a city or community to evolve and improve itself, it must, like any other living organism, live in accordance with what he terms the "complexity-miniaturization-duration paradigm".[65] Invoking organic philosophies based on vitalism (see 7.2.2), and in line with the modern ecological view of science emphasising a holistic, systemic view (see 7.4), he argues that all of nature, "from bacteria to God" conforms to an imperative involving three fundamental principles:

1. COMPLEXITY. Many events and processes cluster wherever a living process is going on. The make-up of the process is immensely complex and ever intensifying.
2. MINIATURIZATION. The nature of complexity demands the rigorous utilization of all resources - mass-energy and space-time, for example. Therefore, whenever complexity is at work, miniaturization is mandated and a part of the process.
3. DURATION. Process implies extension of time. Temporal extension is warped by living stuff into acts of duration, i.e., the eventual "living outside of time".[66]

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[59] Soleri cited in Mayne, *Soleri's Cities: Architecture for the Planet Earth and Beyond* (1993)
[60] P. Soleri, *Arcology* (1969), p. 1
[61] *Ibid*
[62] Teilhard. de Chardin, *Building the Earth* (1965), p. 9
[63] Soleri, *Arcology* (1969), p. 1
[64] Soleri cited in Stanishev, (1993), p. 61
[65] Soleri, *Arcosanti* (1983), p. 15
[66] *Ibid*

In nature as an organism evolves its complexity increases and it develops into a more compact and miniaturised system. In this way the process of evolution is acting against the direction of entropy. As William Irwin Thompson (1975) wrote:

> ...as matter moves towards more probable states of molecular disorder, life moves towards increasingly more improbable states of maximum molecular organisation. More and more is packed into less and less, until the miniaturization process reaches its greatest level of what Teilhard calls "complexification" in the compactness of the human brain. The simplicity of its size and shape belies the dazzling complexity of its interior.[67]

Soleri suggests that the city should follow the same process in order to become a "more lively container for the social, cultural, and spiritual evolution of [humankind]". More events can occur in a more complex system. An increase in "eventfulness" brings with it the phenomenon of "liveliness".[68] Miniaturization occurs as a result of complexity rather than simply through a reduction in size. The main physical characteristic of the brain , for example, is not its size but its complexity. But since he argues that miniaturization increases with complexity (the degree of complexity is directly related to physical space) Soleri suggests that urban complexification demands that higher population densities within cities be created in an efficient way, which enhances people's lives and promotes personal growth. Like the human body, he says, the city must be an efficient organism. Compactness is seen as the structure of efficiency. Through compactness, the energy flow (metabolism) is held in balance with the function that is being performed. Soleri's 'compact city' is a three-dimensional city in which the vertical dimension is appropriate to the horizontal dimension. The city is conceived as a solid and not a two-dimensional 'surface'. Miniaturization in this context is a physical phenomenon that keeps things together in order that they can perform better and achieve higher levels of efficiency. In Soleri's definition the compaction of urban space allows for the miniaturization of city and the removal of elements such as streets, roads, car parks, etc. allowing higher levels of social interaction, intensity and liveliness, within and urban 'complex'. The three-dimensional city, because of its efficiency, is respectful of the earth's ecological system and its atmosphere. "It does not pollute the earth".

> [the] tearing apart [of] our towns and cities, is a degenerative process, not a growth process. It is necessary instead to have a miniaturizing contraction.[69]

"Miniaturize or die has been the key rule for incipient life", Soleri says.[70] But since the modern two-dimensional city does not follow the complexity-miniaturisation-duration paradigm,

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[67] Thompson, (1975), p. 35-6
[68] Soleri, *The Bridge Between Matter and Spirit* (1973), p. 207

he argues, it suffers from "horizontal gigantism and vertical dwarfism".[71] It cannot improve itself. Eventually it losses sustenance and dies.

> In evolution simplicity is always linked with complexity: while huge dinosaurs lumber into extinction, tiny mammals chatter in the trees. I would say it is much the same with our cities now. The huge megapolitan beasts are sprawling all over the earth; in terms of thermodynamics, they are spreading their energy equitably through space and are approaching the heat-death of entropy. They destroy the earth, turn farmland into parking lots, and waste enormous amounts of time and energy transporting people, goods, and services over their expanses. They so fill their ecological niche that they destroy it, and thus become caught in their own evolutionary dead end.[72]

The city is, and has always been, the most complex of social events. In Soleri's view, it owes its existence as much to the human need for congregation, as to the market exchange of surplus goods or the expression of military or political power. He sees in the urban effect the city's role, not only in maximising ecological potential, but as an actor in a process that gives meaning to life by helping to transform the human condition. The development of a new urban instrument is, for him, fundamental to developing a new society and a renewed trust in the future. The two main platforms of arcological thinking are *ecological* and *theological.*

8.5.2 The ecological platform

Arcology's ecological model derives from the source of its implosion – the elimination of the motor car, and the reclamation of all the space associated with the culture of this form of transportation in roads, car parks, showrooms, garages, petrol stations, repairs, junkyards. Developed from his doctoral research in human ecology, completed in 1946, Soleri's conception, in opposition to the fragmented nature of current cities, involves the creation of a new physical layer, what he calls a "neonature".[73] The scope of arcology, as he defines it, is to produce a theoretical model for this new landscape that would be designed to support biological, human, and social evolution while containing human societies along with all their material goods. The aim is towards an alternative urban environment, which moves away from the traditional model of urban sprawl and its inherent cycle of increasing production, consumption, pollution and waste.

> The city is like an organism. Soleri has tried to define what it is that the city has to take in, and what it doesn't need to take in (what is harmful). If we can define those elements more accurately (and many

[69] Soleri, *Arcology* (1969), p. 122
[70] *Ibid*
[71] Soleri, *The Bridge Between Matter and Spirit* (1973), p. 24
[72] Thompson, (1975) pp. 35-6
[73] Soleri, *Arcology* (1969), p. 20

> of those things are economically driven) then we have a better opportunity for sustainable city in which everyone prospers.[74]

Soleri's friend Umberto Eco writes in *structuralist* terms on the symbolic importance of architecture and suggests that architects must design structures for "variable primary functions" (the conventional uses) and "open secondary functions" (the symbolism or communication). Architecture, in this sense, becomes primarily an informational process rather than a material activity. In *Travels in Hyperreality* (1986) he describes Buckminster Fuller's *Geodesic Dome* built for the 1967 Expo in Montreal as perhaps the best example of this to date. Describing the U.S. pavilion he wrote:

> ...the symbols inside were recognisable, but in the end they told us what we already knew, ...underscored a typical image of the U.S,...The only element which did not ...but added something new even if intangible and ambiguous was the Fuller dome. In other worlds the dome was aesthetically the strangest element of the pavilion, and it was so full of nuance, so open to different interpretations, that it affected the symbols inside and added depth to their easily identifiable, more superficial qualities.[75]

Soleri needs to be taken seriously because few other environmental thinkers have contributed as much to understanding how the city operates in advanced industrial societies. His critique could, according to Luke (1997), "greatly improve radical ecology's intellectual mission of world disclosure".[76] For Soleri, adopting a position historically rooted in idealism, sees architecture as more of a social calling than a material activity. Because it is primarily an informational process it can help lead to an ecological revolution.

> Architecture is the alterations made upon nature by the organic, the psychological, the mental, the components of man's consciousness where the social-cultural stresses operate within and emanate out of the human kind. Architecture ...is not only a shelter for communication and information institutions, but it is also...mass information itself.[77]

For Eco architecture acts as a stimulus "only if it first acts as a sign". The built environment is both the material embodiment and expression of society. The environmental crisis within our cities signifies a crisis within individuals and in society. One is the cause and reflection of the other. The radical transformation of society thus requires, not only that we change our paradigms and our social, cultural, economic and political institutions, but also our most fundamental

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[74] C. Tribken , Phoenix City Councilman cited in D. S. Mayne (ed.), *Soleri's Cities: Architecture for the Planet Earth and Beyond* (1993)
[75] U. Eco, 'A Theory of Expositions', in *Travels in Hyperreality,* (Picador, London, 1986), p. 302
[76] T. Luke, 'Developing an Arcological Politics' in *Ecocritique: Contesting the Politics of Nature, Economy and Culture* (University of Minnesota Press, Minneapolis, 1997), pp. 156-7.
[77] P. Soleri, *The Omega Seed: An Eschatological Hypothesis,* (Anchor Press/Doubleday, Garden City, New York, 1981), p. 223

information technology: the architecture of the built environment. Soleri sees ecology and sustainability as simply part of our theological and technological evolution. The architect's sacred task of ecological design is then directed towards the attainment of the *Civitas Dei* (City of God).

Ecology becomes humanity's most important science because the Earth's ecosystems contain the processes by which matter will eventually become spirit. Aesthetic living, in which art is seen as an agent of transformation (what Soleri calls "esthetogenesis") is key to an ecology-environment-theology triad; the environment represents the "imminent manifestation of an eschatological drive", religion provides an anticipated model of perfection , and the aesthetic offers the emergence of spirit from matter through specific forms of "grace" (a painting, a piece of sculpture, a novel, a building, a city).[78] Aesthetic imagination and artistic discipline provide the individual spark that gives the non-living world spiritual significance.

8.5.3 Soleri's philosophical heritage

Arcology is not a reductivist system. Because it aims at a different way of life, it does not attempt to be a conceptual reduction of any sort, but rather a form of synthesis. While its ecological and holistic perspective is admirable this inevitably leads to a wide-ranging scope of research which makes the literature difficult to classify within any specific field of inquiry. The philosophical and theological scope of his thinking crosses traditional boundaries between the subjects of architecture, ecology, biology, urban design, sociology, environmental studies, and art. His wide philosophical reach, ranging from speculation on the evolution of the cosmos to his eschatological hypothesis is daunting but the integration of his philosophical and theological thinking with ideas about the design of cities has given Soleri a unique status both as a philosopher and as an urban planner.

Since his writing does not conform to any specific scientific and his books contain few references or citations, other than those to Pierre Teilhard de Chardin, it is difficult to find verifications that might support his conclusions within his own text. Some who have attempted to trace the origin of Soleri's philosophy have encountered problems:

> Not even Soleri is aware of his own borrowings. The indirect effect of this process is twofold. On the surface it gives the idea of supreme arrogance because he does not seem to recognise anything outside the net he is weaving. But deep down there is supreme modesty because he takes himself to be just an instrument of a larger design. The apparent arrogance comes from Soleri's concept that we must

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[78] Soleri, P. (1981) *Fragments: A Selection from the Sketchbooks of Paolo Soleri*, New York, Harper and Row, p. 190.

> express our potential radiance in a bold and non-apologetic manner by transforming ourselves and our habitat.[79]

Henryk Skolimowski explored Soleri's philosophical propositions in a series of publications in the 1970s (Skolimowski, 1971; 1976; 1977a; and 1977b)[80] and believes that his two main sources are Friedrich Nietzsche and Teilhard de Chardin. "Soleri is Nietzschien", Skolimowski argues, "in the sense that he considers mediocrity to be (almost) a sin against human nature, and he considers the quest for perfection to be an imperative of human purpose".[81] But the difference between his idea of the perfect human being and Nietzche's 'Superman' lies in Soleri's interpretation of de Chardin's Omega Point theory. Soleri, after de Chardin, takes the environmental movement's mantra of "Thinking Globally and Acting Locally" to a new dimension:

> We must realise that we are part of something bigger than ourselves and act in accordance with that. We are cosmic stuff, and unless we are clear on that we are bound for problems. We must stop taking the small view of things. The larger view needn't be sacrificial. I t can be a most incredible leap into something really most exciting.[82]

For both Soleri and de Chardin, evolution is the driving force pushing consciousness to greater levels of awareness. In *The Phenomenon of Man* (1959) de Chardin put forward the proposition that evolution is driven, not by an initial force (or "Father-God") but by a final source of attraction (or "Son-God"), albeit with the same qualities and characters attributed to the Judeo-Christian God. [83] The 'Omega Point' is the final and highest stage in the evolution of the human phenomenon.

8.5.4 The theological platform

The search is under way for remedial and restorative responses, whereby a redefined urban system might restore health and well-being to humanity and to the earth's ecosystem via a more sustainable instrument of urban living. As critical as this project undoubtedly is it is not the main reason why Soleri argues that the "arcological commitment" is indispensable. There is a specifically creative aspect to Soleri's enterprise, which sees the city as a necessary instrument in

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[79] J. B. Cobb in P. Soleri, *The Bridge Between Matter and Spirit* (Anchor Press/Doubleday, Garden City, NY., 1973), p. 3

[80] In addition to Skolimowski (1971) cited earlier his work on Soleri can be found in 'Teilhard, Soleri and Evolution' in *Eco-Logos* 22 (1976), pp. 793-800; 'Arcology as a State of Mind' in *The Teilhard Review* 12 (1977), pp. 247-8; and 'Arcology as an Expression of Process Theology' in *The Teilhard Review* 12 (1977), pp. 238-9

[81] H. Skolimowski, Foreword in P. Soleri, *Fragments: A Selection from the Sketchbooks of Paolo Soleri* (Harper and Row, San Francisco, 1981), p. xi

[82] Soleri cited in Monczunski, (1998-99)

the human evolutionary process. Because we shape our environments and are then, in turn, shaped by them, he argues that cities can have a positive role in our evolution by helping to enlarge the potential of human societies. This emphasis connects him with a long line of urban theorists including Patrick Geddes (1915), Lewis Mumford (1937), Paul and Percival Goodman (1947), Christopher Alexander (1965), and Peter Calthorpe (1989).

8.5.5 The omega seed hypothesis

Much of Soleri's written work was produced during the 1960s and 70s when he engaged with many pop icons of the era - Mashall McLuhan, Buckminster Fuller, Woodstock Nation, the Whole Earth Catalogue - in his discourse on arcology. Although the context seems dated, and the style of writing is complex and esoteric, a lot of it seems to be even more relevant to the problems of our own age. Much of what he wrote seems anachronistic when we read it today.

In his "eschatological hypothesis", *The Omega Seed* (1981) Soleri acknowledges the "Teilhardian imprint" in his work and advocates patterns for the creative evolution of human life that aim towards a perfection only achievable at the end of the Universe[84] (see Plate 4). As in his previous work, *The Bridge Between Matter and Spirit is Matter Becoming Spirit* (1973) the book aims at a synopsis of his philosophical ideas and the fundamental aspects of his arcology theory. Together the books form the core of Soleri's philosophical and theological project. The central message in both is that only by bridging the gap between matter and spirit will intelligent life be directed toward a future deity. He argues that the catalyst of this creativity should be a city that is coherent with an evolutionary process that has been transformed from matter at the beginning of the Universe, into pure spirit at the end. He sees urban sprawl, the model we are currently producing, as fracturing the bridge that channels matter into spirit.

Soleri partially adopts the hypothetical model of a closed-ended Universe, developed by Hawkings (1989),in which reality started with the "Big Bang" some 13 billion years ago. As predicted by Einstein' general theory of relativity, which says that empty space itself is stretching and taking galaxies along with it, the Universe is expanding and will end in a black hole, a "singularity of infinite compression" operating under such powerful gravitational forces that it will suck everything, including light, allowing nothing to escape.[85] The second law of thermodynamics defines the future as an arrow of time in which ice cubes melt, buildings collapse and disorder increases in the Universe. Finding it difficult to accept this ultimately fatal

[83] Teilhard de Chardin, *The Phenomenon of Man* (1965)
[84] P. Soleri, *The Omega Seed* (1981)
[85] S. Hawkings, *A Brief History of Time* (Bantam Books, London, 1989)

view of the future, Soleri posits another destiny for humanity where the possibility exists of "transcending this fate of annihilation into a radiant resolution" through the transformation of matter toward the direction of spirit (in Soleri, 1973; 1981a; 1981b; and 1993). He sees that the human task is to "transfigure the deterministic Universe...into a compassionate, ultra-logical, and ultra-rational reality".[86] He understands reality as a cosmic metamorphosis "that began as a point of mineral light at the 'Big Bang' and will end as a point of radiance of unknown 'nature'", the Omega Seed. Soleri has called this theory the *Omega Seed Hypothesis* and his theological views and eschatology have attracted the interests of a group of theologians (Rogers, 1973[87]; Lewis, 1977[88], and Dolin, 1979[89]). Harvey Cox, Professor of Divinity at Harvard, and John Cobb, Professor of Theology at Stanford have both endorsed is work. Soleri describes himself as "a Teilhardian devoid of God, a neo-Teilhardian"[90]

According to his evolutionary theology between the Big Bang and the Omega Seed, the continuum of reality defines a progression of events that move and change the components of reality (mass-energy and space-time) through four stages; from the probablistic stage, through the opportunistic stage, to the compassionate stage (where we are now), and eventually to the spiritual stage at the Omega Seed. The model he presents identifies the "ecological transformation with a theological development. A God being slowly and painfully created".[91]

The idea of "transforming reality" from "matter into spirit" seems like the plot of a pulp science fiction novel but Soleri argues that the Omega Seed project is not about what is "feasible" but rather about what is "desirable":

> Omega Seed is not feasibility-driven but desirability driven, I am not trying to tell myself what reality *might be*, I am trying to tell reality what *it ought to be*...[it] won't come automatically or randomly...we have to create it ourselves.[92]

By placing the fruition of the Omega Seed so far into the future it make s the acceptance of the hypothesis as a guide to current action difficult but humans have, throughout history, been guided by the pursuit of utopias. In the justification of his Omega Seed utopia, Soleri says:

- it gives meaning and direction to the human condition;
- it offers the possibility of justice, beauty and grace;

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[86] Soleri, *The Bridge Between Matter and Spirit* (1973), p. 120
[87] D. G. Rogers, 'Paolo Soleri' in *Christian Ministry* 4 (1973), pp. 21-6
[88] R. Lewis, 'Residual Anguish, Compassion and Aesthetogenesis in Soleri's Arcologies
[89] J, Dolin, 'The Relationship of the Arcological Architecture of Paolo Soleri to The Evolutionary Thought of Teilhard De Chardin', (Doctoral dissertation, Ohio State University, Athens, OH, 1979)
[90] Soleri, *Technology and Cosmogenesis* (1985, p. 121
[91] Soleri, *The Omega Seed* (1981), p. 19
[92] Soleri , *The Bridge Between Matter and Spirit* (1973), p. 183

- it demythologises the past;
- it gives an explanation to suffering - the consequence of a reality in the process of creating itself;
- it puts the responsibility of transcendence on human beings.

The mandate he draws from this is that human society needs to continuously strive towards transformation in order to achieve its inner cosmic potential. He argues that if we could develop an understanding of the dynamics of the process whereby inorganic matter turns into living, we might be able to create the tools of this transformation.

Humanity stands in "the flow of evolutionary process and gains its meaning from its place and role in that process".[93] Cobb (1981) points out that Soleri is engaged in the "theological reformulation" of this vision but he goes far beyond Teilhard in his analysis of what this means for us in contemporary society. Teilhard's vision failed to offer guidance for present action. To Cobb Soleri's arcology theory offers today's Church "torn between its historic-future-orientation and its awareness that it offers no convincing vision of a hopeful future", a "beacon of hope". The concrete implications of Soleri's vision proposes the building of the *Civitas Dei* as the next step in the progressive transformation of human existence.[94] The urban effect is "the principle whereby the interaction of individuals gives rise to new forms and new levels of individuality and community".[95] The function of arcology is to facilitate the breakthrough to these new levels.

8.6 Evolutions in arcology

Soleri asserts that "the most common mistake" about his work is the assumption that "years of introspection have produced a take it or leave it package…rather" he says "I am proposing a methodology and at the same time trying to illustrate it ".[96] The methodology was initially developed within the Mesa City Project and illustrated in *The Sketchbooks of Paolo Soleri* (1971).

8.6.1 Mesa city

Throughout the 1950s and 60s Soleri developed his urban theories while experimenting *in silt-casting* techniques for producing ecological structures. During this period he also gained recognition as an ethical philosopher, social critic and architectural visionary, and grants from the Graham (1961) and Guggenheim (1964) Foundations for his work on the *Mesa City Project*

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[93] Cobb, 'Paolo Soleri and Christian Faith', Preface to Soleri, *The Omega Seed* (1981), pp. 13-26
[94] *Ibid*
[95] *Ibid*

(1958-67). This was a theoretical regional plan to house 2 million people on around 55,000 acres (about the size of Manhattan Island) on an isolated and pre-flattened desert plateau.

Developed as part of Soleri's ongoing research in the field of "architecture as human ecology" Mesa City was specifically aimed at introducing the idea of "corposity into the urban morphology, a premonition of the arcological concept".[97] The project, which pre-figured the arcology concept, is described by Soleri (1971) as a quest to find "an environment in harmony with Man", one which would stand as an "ecological organisation of nature within the new balance demanded by large social aggregates".[98] It consists of clusters of rural towns and villages, multipurpose structures housing social facilities for living and working designed to capture and make use of cosmic energy (solar, wind and water power) and its derivatives. This aspect developed from Soleri's "Cosmic Potentials" project (from 1950) which considered "energy collection and consumption and the performances of individual and collective man within one structure ".[99]

Set on top of the widest end of a semi-arid desert plateau, the drawings and models of Soleri's "City on a Mesa" show an organic bone-like plan surrounded by agricultural and grazing land (see Plate 5). The elongated form stretches to around 35 kilometres long and 10 kilometres wide. Along a waterway created by an elaborate system of dams reservoirs and canals. The "backbone" of social activities stretches from the centre for advanced study in the south, through the man-made " Central Park", to the theological complex in the north. The park would act as both the source of quarried building material on one side and a sculptured landscaped park, complete with museums, churches, and amphitheatres on the other. Thirty-four arts and craft villages (with 3,000 people in each) are clustered in groups of five, around civic and retail facilities that circle the Centre for Higher Learning on the south end. Each of these pedestrian villages is 1 kilometre in diameter, with on average a 300 metre public garden at its centre. The whole area is criss-crossed by pedestrian and bicycle paths and there is no vehicular traffic of any kind within the city centre. High-density dwellings line the east and west side of the main park on sloping grounds allowing for a terraced plan, similar in form and scale to the Casa a Gradinate at Sant'Elia's 'Città Nuova'. And like Le Corbusier's Contemporary City, a business centre consisting of a complex of towers complete with a roof-top airport, is located at the city's centre.

[96] Soleri, *The Omega Seed* (1981), p. 206
[97] P. Soleri, 'Mesa City: A Quest for an Environmnet in Harmony with Man' in *The Sketchbooks of Paolo Soleri* (MIT Press, Cambridge, Mass., 1971), p. 1
[98] *Ibid*
[99] *Ibid*, p. 11

Three belts surround the main city; the inner belt with workshops and living quarters integrated to the circulation network; the middle belt consists of a network of speedways, roads, parking places and a system of waterways for freight and passengers. Along this band are located the industrial commercial, entertainment and cultural facilities. Furthest away from the social backbone, the third is located underground and consists of consists of a ribbon of second-hand stores and markets, car and equipment dealers and junkyards. Processing and recycling plants are positioned at the foot of the mesa .

Mesa City was not designed as a blueprint or masterplan but as a series of ideas as to how such an organism might develop. The centre for advanced study and a research facility in biophysics and biochemistry would be designed and built first, polarising all the energies and efficiencies needed to implement the growth of the city. The villages and civic centre would follow along with segments of the "life-carrying" bands around the perimeter. The theological complex would then be created to balance the mind centred learning complex. When the three perimeter belts were completed they would determine the conditions for growth of the high-density community. The axial park would provide the substance for the cultural growth of the towns and villages within the "linear city".

Although there are parallels with Le Corbusier's plans of Radiant City in terms of the anthropomorphism, the linear morphology and scale and ambition of the Mesa City project, Soleri's organic and biological concerns is the source of fundamental differences. The idea of zoning, advocated by Garnier, Gropius, CIAM, and Le Corbusier, is sacrificed in Mesa City to the notion of the city as human ecology, wherein the city/organism mirrors the complexity of life within its own structural complexity. The city is meant to grow. Soleri's arcological urbanism sees Mesa City as an "aesthetic organism with compassion as its content", a new human-made setting (a "neonature") for the purposeful transfiguration of the natural environment "not just sparsely and haphazardly 'colonised' but ecologically humanised".[100] Located between the wilderness and megalopoly it was to be a forerunner of a series of *arcologies*:

> ...powerfully built organisms, modular ecologies [that] would rise high in the sky, roots deep in land and seas. Their skeletal framework would provide for the "functional" needs, and the citizens, thousands of minds and hands freed from repetitive labor would give a part of their lives to the ultrastructuration (aesthetogenesis) of a truly three-dimensional environment conceived by man and dedicated to him.[101]

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[100] *Ibid*, p. 7
[101] *Ibid*

8.6.2 *The city in the image of man (first generation arcologies)*

Just as Sant'Elia had done in 1914 with his Città Nuova and Milan 2000 exhibition and the accompanying publication of the *Messaggio,* Soleri published his own form of 'manifesto' as *Arcology:the City in the Image of Man* in 1969 and followed with an exhibition of drawings and models entitled 'The Architectural Vision of Paolo Soleri', which toured the U.S. and Canada to record attendance figures throughout the following year. In both the book and the exhibition he sketched out giant structures that would dwarf the Empire State Building. He calls these structures 'arcologies' (architecture + ecology) to underline their conceptual basis, both in the discipline of architecture and the science of ecology.

> *The concept is that of a structure called an arcology, or ecological architecture*...Such a structure would take the place of the natural landscape inasmuch as it would constitute the new topography to be dealt with. This man-made topography would differ from the natural topography in the following ways:
>
> - It would not be a one-surface configuration but a multilevel one.
> - It would be conceived in such a way as to be the carrier of all the elements that make the physical life of the city possible - places and inlets for people, freight, water, power, climate, telephone; places and outlets for people, freight, waste, mail, products and so forth.
> - It would be a large-dimensioned sheltering device, fractioning three-dimensional space in large and small subspaces, making its own weather and its own cityscape.
> - It would be the major vessel for massive flow of people and things within and toward the outside of the city .
> - It would be the organizing pattern and anchorage for private and public institutions of the city.
> - It would be the focal structure for the complex and ever-changing life of the city.
> - It would be the unmistakable expression of man the maker and the creator. It would be diverse and singular in all of its realizations. Arcology would be surrounded by uncluttered an open landscape.[102]

Although they were designed for different environmental contexts like oceans, deserts, mountains and canyons and varied considerably in size, shape and form, the structures are conceived of, after Mesa City, "in the Image of Man" and, like the early Humanist ideal cities of the Renaissance and Le Corbusier's *La Ville Radieuse* (1933), they exhibit features of the human body. The outer layer of an arcology is analogous to the eyes and ears of the 'organism'. Attached to the skin and in immediate contact with the outside world are the residential areas, which although they look out over the wilderness are part of the city. Nature exists outside and the city is sharply distinct from it but citizens would have immediate visual and physical access to it. These outer areas also contain parks and transport nodes but it is the dwellings that characterise the outer surface, as a sensitising skin. On the next layer, in the 'mind' of the arcology, there are public facilities like offices and shops, schools, theatres, museums and

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[102] Soleri, *Arcology* (1969), p. 13

libraries. These are the places where people obtain services, where they work, gather and play. And then deep in the central core of the city were the power plants, warehouses and heavy industry. Like the internal organs, the digestive and vascular systems, the core involved the basic 'life processes' that underlay the workings of the 'mind' and the 'sensory' parts of the system.

> The natural landscape is not the apt frame for the complex life of society. Man must make the metropolitan landscape in his own image: a physically compact, dense, three-dimensional, energetic bundle, not a tenuous film of organic matter. The man-made landscape has to be a multi-level landscape, a solid of three congruous dimensions. The only realistic dimension toward a physically free community of man is toward the construction of truly three-dimensional cities.[103]

Related as it is to the development of modern biology and the science of life, the notion of the city as an organism is a fairly recent one. The pairing of human organs and elements of urban form on the basis of functional similarities seems to have satisfied an urge to affirm the primacy of idea urban *life*. Open spaces such as squares and parks have often been described as the 'lungs ' of the city while the centre is invariably the 'heart', pumping 'blood' (traffic) through the 'arteries' (streets). The biological analogy has been extended to encompass urban economics where the habitat is the 'cell'; the city's financial district, industrial area or suburbs are 'organs' or specialised tissues; and capital, whether in the form of money or buildings is the energy that flows through the urban system.[104] As described in [7.6.1], Giradet (1992) also develops the analogy to describe an approach to urban resource maximisation through the city's adoption of a circular "metabolism".

Other aspects of organisms, their structural logic and their pathogeny have been used to support the "organic" metaphor. Plants and animals have definite boundaries and self-regulating systems of growth; they are subject to processes of change that can be predicted and planned for. Changes in their form are as a result of functional requirements. The argument is that the same should be true of "organic" cities. Like other organisms, cities are subject to disease and decay. Much of the nineteenth century urban literature establishes a causal relationship between the built environment and the physical and social health of urbanites and places the root cause of the pathological deterioration of the urban fabric in the Industrial Revolution [7.4].

But, as Kostof (1992) warns, the comparisons between organisms and cities is only useful up to a point. An insistent overemphasis on the idea of the "living" city inevitably comes across as false, and leads to confusions. It is human purpose and willfulness that drives the creation of

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[103] *Ibid*, p. 14
[104] As in, for example, S. Olsen, 'Urban Metabolism and Morphogenesis' in *Urban Geography* 3 (2), (1982), pp. 87-109

cities.[105] As Lynch (1981) points out, "Cities are not organisms...They do not grow or change themselves, or reproduce or repair themselves".[106]

The thirty *first generation arcologies,* designed between 1963 and their publication in 1969 consist of two groups: *Dionysian* and *Apollonian.* Dionysian arcologies are affiliated to Mesa City and are configured in a "free form" character. Like Novanoah II (a city for 2,400,000 to float on coastal waters or open sea), Arcoforte (20,000 people on a sea cliff), Veladiga (15,000 people on a dam site), Stonebow (200,000 people above a ravine or canyon), and Theology (with a population of 13,000 set within a cliff). Apollonian arcologies are characterised by the elementary geometry of the envelope and the simplicity of the form: a cube, sphere, pyramid, hexahedron, cylinder, etc. Examples of these are Arcube (a city of 400,000 people located on flatlands), Hexahedron (a city of 170,000 on any topography), and Asteromo (70,000 people living in space) and the original proposals for Arcosanti (for 1,500) (see Plate 6).

Soleri does not make a qualitative distinction between these types in terms of function but does point out the dangers of imbalance within free form when "for the sake of nonsymmetry there is a lopsided density of action that will result in hyperfunctions in some places and atrophy in others".[107] Certainly the departure from the "organic" form of Mesa City signalled a shift in Soleri's thinking and marked the next stage in the evolution of the arcology concept when, during the 1970s, predominantly symmetrical structures were designed to respond to the symmetry of the Sun's trajectory.

8.6.3 The two suns arcology (second generation arcologies)

With the development of the next generation of arcologies, *The Two Suns Arcology* (1975) in responding to the growing energy crisis of the mid-70s Soleri split the architectural concept of the first generation structures in half "exposing the core to the sun" (see Plate 7). This produced some highly significant related effects; it gave greater priority to the main source of renewable energy and placed the arcology concept much more firmly into its own ecological niche. The ideas that emerged in *the second generation arcologies*, within the concept of the "energy city" served to reinforce the relationship between architecture and ecology.

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[105] S. Kostof, *The City Shaped* (1992), p. 53
[106] Lynch, (1981), p. 95
[107] P. Soleri, 'Arcube' in *Arcology* (1969), p. 112

In 1975 six major (and simple) architectural "effects" were described, collectively under the aegis of the "urban effect".[108] As Luke (1997) has pointed out these offer a "remarkable solution for many of today's environmental problems":[109]

> The *greenhouse effect* is a membrane that seals off an area of ground that can be cultivated, extending the growing season to practically twelve months, and also saves a great amount of water...With the "greenhouse", one has intensive agriculture, limited use of water and extension of seasonal cycles. This is the *horticultural effect.* Then there is the *apse effect.* Some structures can take in the benign radiation of the sun in winter months, and tend to cut off the harsh radiation of the sun in the summer. By the *chimney effect,* which is connected with the greenhouse effect, one can convey, passively, energy through the movement of air; the heat from one area to another. So we have these four effects; there is also the capacity of masonary to accumulate and store energy - *the heat sink effect.* With relatively large masonary, one can store energy during the warm hours of the day, and give it out during cool or cold hors of the night. The intent is to see if these five effects can be organized around what I call the *urban effect.* The urban effect is the capacity of mineral matter, to becom lively, sensitive, responsive, memorizing...If we were to co-ordinate those six effects together, then we definitely could save on resources like land, water, time, energy, materialism, and have a better ecological sanity.[110]

These effects were combined in a series of designs for second generation arcologies, including *Air Dam Arcology*, *India Village*, *Maryland Arcology*, and *Regina Arcology* (see Plates 8, 9 & 10). In these arcologies the entire form of the urban structure , as well as a huge area of south-facing greenhouses containing vegetable gardens, are designed to maximise the use of solar energy while reducing dependence on external energy sources.

8.6.4 Habitats for shifting populations (third generation arcologies)

By the end of the 1970s Soleri had developed the *Two Suns* concept into proposals for *third generation arcologies* that would package the combined energy and urban effects of the *second generation* into modular and standardised structures that could be articulated in a variety of arrangements and sizes to respond to changes in the environment, the climate, the available technology, and the size of the community.

The methodology adopted uses the *apse* form as the generating structure to define the prototype for what Soleri describes as the "post slab" habitat. Research and development work on the *Two Suns Arcology* had led to the idea of taking the slab and manipulating it in order both to increase its inherent strength, while at the same time, enveloping space. The apse then also became the anchoring device onto which transparent and translucent membranes and shading devices were attached via a tensile mechanism. This "garment architecture", along with the apse defines areas of external space that are climatically modified so that temperature, moisture, and

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[108] P. Soleri, 'Two Suns Arcology' in *aaq* 7 (2), (1975), pp. 33-41
[109] Luke, (1997), pp. 161-2
[110] Soleri, *Technology and Cosmogenesis* (1981), p. 137-8

air circulation can be altered as, and when needed. The apse form acts as a passive solar device when orientated towards the Sun, which allows the structure to retain heat in the winter and provide shade and cooling in the summer (see Plate 11). The *apse effect*, along with the other effects (*greenhouse, chimney and heat-sink*) act collectively to define the physical climate of the entire habitat. The shift from the slab to the apse is a highly significant step in the evolution of the arcology idea in that it signals the move to a more environmentally responsible and resource efficient design while introducing an architectural form which can provide a social and cultural focus for the community that might inhabit it. The *Valetta Spring* complex, designed for Arcosanti, demonstrates the main designs principles of the *third generation arcology* (see Plate 12).

Climate control within the three-dimensional landscape of an arcology can, through various spatial and functional adaptations of the prototype (for example, changes in scale, orientation and morphology, and the introduction of additional elements) be designed to a variety of uses and environmental contexts.

These, he proposed, could serve human population shifts of various types including:

- Migration from old (and modest) settlements to new (and stronger) ones. The problems associated with urbanisation are, in large part, the " wages of progress" but the enormous social and environmental problems generated threaten to overwhelm society.
- Migration caused by climatic changes. Mostly caused by overtaxing the environment leading to global warming. During the last ten years severe droughts, floods, famines, cyclones, and hurricanes have raised the spectre of massive demographic shifts associated with climate changes and its effects.
- Migration caused by technological development that foster over-exploitation of natural resources for economic growth.
- Political refugees seeking asylum.
- Travel for education (new transnational or global dimensions of learning and knowledge seeking), business and tourism.
- Accommodating the renaissance of pre-existing or indigenous cultures via "pollination".
- The colonisation of space.

8.6.5 Space for peace (fourth generation arcologies)

In direct opposition to the Reagan administration's strategic defence initiative within the "Star Wars" programme of the mid-80s Soleri proposed his own initiative, called *Space for*

Peace, as a development of the earlier *Asteromo* project (one of the arcologies published in 1969) into a *fourth generation arcology.*[111]

From 1984, Soleri produced a series of images and models focusing on the notion that space will eventually be peppered with space cities or colonies. In the tradition of those who, throughout the twentieth century have been exploring the possibility of life beyond the Earth's boundary (for example, Tsiolkovsky 1923, Bernal, 1929; Dyson, 1971; Bond, 1973; and O'Neill, 1977 [1.11]), the *Space for Peace* project was an attempt to predict what some of the characteristics of space habitats could be. *Asteromo* was designed as a space community of 70.000 people engaged in research in astronomy, physics, and space chemistry, located on an asteroid. In 1969 the stated aims involved testing the conceptual foundations of arcology by[112]:

- exploring the rigorous confinement and inward orientation of a community within a membrane;
- examining the loneliness of living in the "non-environment" of space;
- defining an ecology and the balance of performance within it;
- the self-reliance necessary for a system dependent on its own resources and within a hostile environment;
- testing the rigour of the rules of complexity and miniaturization.

Astronaut, Brian O'Leary in *Mars 1999* had suggested that mining asteroids could represent the most feasible and cost effective basis for operations in space. Soleri's designs from 1984 show how asteroids of different sizes and types, once "captured" can be processed into tiny, and relatively simple habitats for people with names like *Euclidean, Urbis et Orbis, Ovum II* and *In-Orbit* (see Plates 13 & 14). Collectively these projects were exhibited under the heading of *Eco-logic Minutiae* (1989).[113] Soleri suggested that these space cities would function as centres of:

- mining, processing and shipping;
- research, testing and production;
- an urban laboratory for environmental and socio-cultural experiments;
- leisure ("decompression habitats") for space travellers;
- building, maintenance, repair and cargo stations for space machines.

The forerunner of *Eco-logic Minutiae* is *Mesa City* (1958) where the broad manipulation of the geological mass of the mesa was carried out, both to generate construction material and to

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[111] P. Soleri, *Space for Peace Monograph* (Cosanti Foundation, Scottsdale, 1984)
[112] Soleri, *Arcology* (1969), p. 116
[113] This work was exhibited at the New York Academy of Sciences in 1989. Ecologic minutiae are described as the extensive ("alchemical") manipulation-metamorphosis of stellar material into minute ecological-mental cells.

transform the natural landscape into a cityscape. Soleri has described the *first generation arcologies* as "Space Cities anchored to Earth" and suggested that they could be seen as testing grounds for the eventual "urbanisation of space".

8.7 Arcology's theoretical response to urban environmental problems

Arcology is capable, in theory at least, of responding to many of today's urban environmental problems; of exponential population expansion and the inefficient use of land, air and water; pollution caused by technological society; energy and natural resource depletion, distribution and consumption; food scarcity; the loss of quality of life through waste, affluence and opulence and the physical and social segregation of people, things and activities, and the increasing problems of social alienation and exclusion. Its methodology recognises the necessity of the radical reorganisation of the current pattern of urban sprawl into dense, integrated, three-dimensional cities in which material recycling, waste reduction, energy conservation and the use of renewable energy sources are part of the sustainable strategy aimed at reducing the flow of resources and products through the urban system. In his biological model for the city there are parallels with Giradet's (1992) idea of cities adopting a "circular metabolism", where consumption is reduced by implementing efficiencies and where re-use of resources is maximised. [114]

8.7.1 Self-containment of habitat

In terms of urban form arcology through its adherence to the complexity-miniaturization-duration paradigm s dedicated to the 'old' notion of containment in opposition to the relatively recent idea of diaspora (where the car is the main protagonist). In nature the idea of unlimited sprawl is adopted by organisms at the lower levels of the evolutionary process. More developed species (like, bees, wasps, ants, and termites) have opted for optimal dimensions for their habitats.

Soleri's metaphor for the city "in the image of man" emphasises the idea of self-containment (See Plate 15). The self-containment of humans within the structure of our bodies allows is to communicate and interact with other humans. Having a complex system contained within a body "is the imperative for any organism capable of connecting effectively with the 'outside'".[115]

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[114] H. Girardet (1992), pp. 22-3
[115] P. Soleri, *Selected Paolo Soleri Papers: 1981-93* Volume 1 (Cosanti Foundation, Scottsdale, 1993) p. 45

Without self-containment the city cannot act effectively with the surrounding natural environment. Soleri argues that "ecological sanity...is dependent on centres of life so intense as to retain within their boundaries (city-town) the bulk of the planetary population and its paraphernalia".[116] But he points out that the converse is also true. When the city looses sustenance from the countryside it is doomed.

> ...if we were scattered to the four winds we would not be able to contain the complex arrangements of matter-energy that allows performance and we would just disappear and die. Arcologies will be contained within a "skin" that will make it possible to "perform and achieve", to communicate, so the city can be in a position to control itself.[117]

8.7.2 Land use

The 30 arcologies presented in 1969 were located on marginal lands, far from main transportation networks, many poor in resources and generally considered difficult to "colonise". Soleri argued that these might be the sort of reserves where future cultures may have to settle, leaving fertile lands free for increasing crop cultivation. Part of Soleri's project is to demonstrate the viability of the self-containment of a community on such inhospitable land. Many civilisations throughout history have had to deal with restrictive eco-systems. They have survived by making the best of the environment. Arcologies use the land, its geological structure and its water as the main physical resource, as well as the sun, the climate and connections with neighbouring communities in order to do more with less.

One of the best methods of altering the impact of cities on the natural environment is through land use. A higher concentration of land use derives from mixed use development. Arcology is mixed use in its purest form - accommodating a variety of uses within one structure (See Plate 16). Soleri describes suburbia as the "ultra-segregation habitat" which acts as a negation of life and liveliness, and incurs high social and cultural costs. In contrast to sprawl, an arcology acts as a large integrated, self-contained structure, in which pedestrian circulation is reinstated as the main method of getting around. Its compact design allows agricultural land and biologically diverse habitats to remain preserved beyond the city's perimeter. In an attempt to reintegrate people with their community arcologies are designed as mixed-use complexes, containing homes, offices, schools, parks, and a cultural centre on the basis that a close interaction of city functions and people will induce a greater sense of community. Mel Roman, psychologist and family therapist, believes that within an arcology:

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[116] Soleri, *Arcosanti* (1983), p. 17
[117] P. Soleri in P. Bonvicini, 'Soleri Dialogues' in *L'architettura: cronache e storia* 422, (December, 1990), p. 874

> ...the integration of living, working and recreation become a very natural part of everyday lives . Its not something you have to take a child to see, to do, but rather something that is experienced in everyday life. [118]

The integration of the three main components of life - living, learning ,working and playing - is a main goal within arcology and points to the reshaping of the entire urban landscape and, along with it, the culture that such a landscape supports. Lewis Mumford regarded the first step toward regaining possession of our souls would be to "repossess and replan the whole landscape". For Soleri the information age offers society an unprecedented opportunity to bring together the main components of life, but the habitat that we have constructed for ourselves during the last century is alien to such integration. Therefore, he argues, it must be reconfigured.

8.7.3 Transportation

Today cities devote up to 60 per cent of their land for car use. Lewis Mumford warned in 1963 that granting cars unlimited access to the city invited the city's destruction.[119] Today his prediction has proved accurate around the world. In the United States traffic jams account for $100 billion a year in lost productivity. Many European cities with good mass transit systems have been all but ruined by cars. London and Paris are among the world's great cities but their environments have been diminished by the near-constant noise and exhaust of cars on their streets. In the United Kingdom the Royal Commission on Environmental Pollution warned in 1994 that in Britain "the unrelenting growth of transport has become possibly the greatest environmental threat". Our car-dominated transport system, the report said, is unsustainable".[120]

Like many critics of car dependency is not against the technology *per se* but against our complete reliance on it for transportation. As just another consumer product, he argues that the car "should be giving back the legitimacy [it has] lost...as an auxiliary mode confined to marginal urban and country drives for work and for leisure".[121] But since our modern culture has become almost totally dependent on the car it is:

> The great villain of the century and quite possibly the great villain of all time...an apocalyptic example of mindless logistics and technological slavery.[122]

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[118] Mel Roman, Family Psychologist cited in Mayne, *Soleri's Cities: Architecture for the Planet Earth and Beyond* (1993)
[119] L. Mumford, *The Highway and the City* (Mentor Books, New York, 1963)
[120] Royal Commission on Environmental Pollution, *Eighteenth Report: Transport and Environment* (HMSO, London, 1994)
[121] Soleri, *The Bridge Between matter and Spirit* (1973), p. 51
[122] *Ibid*, p. 164

While he acknowledges planning efforts that aim to produce more efficient land use patterns thereby reducing the number and frequency of car trips, and the introduction of fuel-efficient technology in car design and manufacture, Soleri contends that such improvements fail to attack the core of the problem. They are, he says, simply "a better kind of wrongness",[123]

By virtue of its compact design, an arcology would allow cars to be relegated to service areas in the city's periphery (as in Mesa City) or reserved for travel between communities. In 1969 he proposed that these be linked to each other via an "urban river", 1 to 1.5 miles wide, whose core would serve for transportation and communication and whose top would be an endless airport. Along this modular urban system, urban nodes attached to arcologies would be located at around 10 mile intervals carrying the bulk of civilisation. Soleri's global version of the Milyutin's "linear city", extends along an international network connecting the five continents via bridges and tunnels (similar to the Eurotunnel). Later, as part of his *Superconductivity Initiative* (1991-3) project, Soleri proposed that the connection between the city nodes would be based on superconductivity transportation technology featuring high-speed trains travelling at 300 mph or faster. Beyond the river, the regional landscape would be made up of agricultural fields, mining areas, and forestry.

8.7.4 Food and energy production

Arcology aims at a degree of autonomy and self-reliance, rather than 'self-sufficiency '. Self-sufficient communities, which aim at total self-provision of food and energy, and the complete recycling of wastes, are according to Soleri "extravagant and devoid of sense" and truly utopian in the sense that they aim for a perfection that, he says, can only exist as the final act in a cosmic process. There is no way the Earth or anything in it, he argues, can be perfect because it is a small part of a much larger system.

The arcology concept is directed instead at a more restrained and judicious use of resources via the power of complexity and miniaturisation and the discipline of frugality. This, Soleri believes will favour a condition of self-sustenance less dependent on external sources.

The degree of self-reliance in food production has changed as the arcology concept has evolved. In *Mesa City* the settlement was designed to be entirely dependent on the produce of the surrounding hinterland and on traditional agricultural practices. With the development of the *Two Suns* approach food and energy (radiant) were to be produced within south-facing greenhouses located within the city. These are designed to support the city's population at a

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[123] *Ibid*

minimum level. Other produce is imported from outside to supplement the goods and services provided on this self-reliant base (e.g. electricity from the main grid).

All Soleri's projects after 1958 have explored methods of generating and harvesting energy from renewable sources and have aimed at transforming the urban structure into an "energy machine". This approach derives from his *Cosmic Potential* period (1958-62) which specifically included work on *Mesa City* and a series of Dam projects, and introduced ideas that would become increasingly important in the evolution of the arcology concept. The focus has, however, shifted from *Mesa City* and the first generation arcologies (1963-9), where the priority was on the design of the urban structure as a social and cultural system operating within an organic metaphor, to the *Two Suns* approach in which the city is conceived of as a complex in which living, working and learning are integrated with food and energy production. The city , still in the "image of man" becomes both consumer and producer. Apses and *exedra* (semi-circular edifices - developed from the apse form) that respond to the Sun's trajectory as energy devices and large expanses of greenhouses attached to the city, are used to generate heat and electricity as well as to grow food, help define the urban structure as an "energy city".

8.7.5 Impact on natural resources and pollution

Arcologies, through a blend of energy conservation and land use efficiencies, together with waste recycling systems, could maintain the ecological integrity of the region while placing fewer demands on the environment in terms of land, water, soil, fuel and other resources (See Plates 17, 18 & 19 (a) & (b)). By reducing the demand for petrol -based transportation systems air quality could be radically improved. Non-pollutant passive solar-active energy systems such as wind turbines, photovoltaic cells, and solar cooling and heating would further help to reduce water, air and land pollution.

The Gaia hypothesis [6.3.1) sees the earth as a self-regulating system in which conditions suitable for life are maintained by feedback processes involving both living things and the non-living part of the planet. In a similar vein Soleri sees both the planet, and the arcology as "a semi-autonomous organism, constantly recycling and digesting parts of itself, constantly redefining its own "constitution".[124] By combining various passive energy strategies within a single integrated urban system, arcology aims at a theoretical and architectural synthesis, in which philosophical, ecological and theological ideas are "woven into a structure of great beauty

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[124] Soleri, *Arcosanti* (1983). p. 24

and integrity, and which, at the same time, is a structure of stunning frugality from the standpoint of energy conservation".[125]

> ...all arcologies are "small" in the sense of their being miniaturization of performance. They take the place of the megastructures of breakdown and paralysis. Los Angeles is a super-megastructure, incorporating all the syndromes of waste, pollution, and segregation. The urban effect of arcology is at the opposite end of the spectrum...a complex, miniaturized, self-limiting habitat is the best site for more efficient, less costly disposal and recycling programs. Naturally frugality is the most cost effective way to confront the pollution-recycling-cost dilemma. [126]

8.7.6 Information technology and arcology

We face a future in which issues of population expansion, per capita food-production, deforestation, loss of biodiversity, global warming, climate change, acid rain, ozone depletion, soil erosion and the pollution of land, water and air are certain to feature more prominently. An increasing strain on the Earth's resources may render arcology an important model for developing urban sustainability policies. Some see the benefits of information technology (IT) as offering widespread solutions to environmental problems. The main assumption is that when the global information system becomes sufficiently advance, we will be able to enjoy increased levels of technological-induced production and consumption, but with less pollution and waste. By increasing the flow of information between the parts of the complex, global industrial machine ("megamachine") we have constructed and reducing the need for travel, we can make it run more efficiently, reduce environmental impact and so help contribute to future sustainability. The argument is that IT is simply part of an ongoing attempt to bring the global "control system" into line with advances in industrial technology. The E.U.'s Information Society Forum (ISF) cites various ways in which IT can help reduce environmental impact:[127]

- delivering productivity improvements for relatively small amounts of resources and materials;
- enabling 'dematerialisation' (for example electronic banking, where transactions are carried out without paper);
- making Third World development less resource-intensive;
- creating more efficient ("smart')transport systems that pollute less;
- reducing the need for mass mobility (for example through telecommuting) and therefore congestion, energy consumption and pollution;
- environmental monitoring via remote sensing.

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[125] H. Skolimowski, Foreword in Soleri, *Two Suns Arcology* (1975)
[126] Soleri, *Arcosanti* (1983), pp. 24-8

Some have questioned whether information technology is necessary or sustainable, if its aim is simply to sell relatively useless information to each other and expand market demand for products that we don't need (electronic devices for an increasing number of activities) and that, in many cases, act to aggravate the already detached relationship we have with the environment.

Although there is some evidence of the environmental benefits of telecommuting[128] the idea that the use of computers will negate the need for urban commuting, is too simplistic. Since the majority of car trips (around 75 percent) in developed countries are unrelated to work IT may actually increase car travel by allowing more people to live in outlying low-density areas. IT-induced sprawl could offset any potential environmental gains by increasing the environmental pressures associated with this form of development. In addition the ISF points to the possibility an IT-induced "rebound effect" where new demands for material consumption are created by the technology itself.

The least desirable form of urban development from an environmental perspective is low-density suburbanisation.[129] The *Habitat Agenda* (1996) highlights the significant environmental impact of urban form. It stressed that in order to:

> ...avoid unbalanced, unhealthy and unsustainable growth of human settlements, it is necessary to promote land-use patterns that minimize transport demands, save energy and protect open and green space.[130]

Within the arcology theory there is the basis of a response to this challenge. It also aims at a different way of life. On a finite planet, in a world of limits that faces a future of dwindling resources and expanding consumption perhaps of far greater benefit than new technology will be the kind of changes to the pattern of our daily activities that a more frugal lifestyle may offer.

Currently there are around 3 billion people but by 2025 there could be around 5 billion people living in urban areas [3.2].[131] A increase of this magnitude in such a relatively short period of time will create severe strains on food supply, housing stock, transportation, sewage treatment systems, urban sanitation and water resources. During the 1990s hundreds of millions

[127] EU Information Society Forum, *Networks for People and their Communities: First Annual report to the European Commission* (June 1996). <http:www.ispo.cec.be/infoforum/pub/inrep.1.html>

[128] A recent study in California indicated that telecommuting in a sample group reduced the number of personal trips by 27 percent leading to emission reductions of 64 percent for carbon monoxide (CO) and 69 percent for nitrogen oxides (NO). P. L. Mokhtarian, 'Telecommunications and Travel Research , University of California Institute of Transportation Studies (Home Page, 1997) <http://www.engr.ucdavis.edu/~its/telecom/>

[129] W. P. Anderson, 'Urban Form, Energy and the Environment: A Review of the Issues' in *Urban Studies* 33 (1), (February 1996), p. 19

[130] UN (Habitat II), (1996), p. 111

[131] UNPD, (1995)

of people were without clean drinking water and sanitation. The rapidly increasing demand for food and resources will result in the inevitable consumption of more land. The increase in population has translated into a human habitat that consumes an increasing amount of arable land. More and more people are being forced onto arid land. There is therefore a growing need to establish how such land can support burgeoning communities throughout the world.

8.8 The hyper building

Many of these environmental benefits have been drawn together in the most recent development of arcology concept dating from 1995. Soleri has been commissioned by the Japanese government to design a 1000 metre-high *Hyper Building* with a projected life-span of 1000 years.[132] Asked by the Hyper Building Research Committee (HBRC)[133] to site his design in a rural location, he has chosen a place midway between Los Angeles ("an icon for hyper-consumption") and Las Vegas ("an icon for hyper-hedonism"), near Interstate 15, in the Mojave Desert. The Hyper Building stands in contrast to these extremes of modern society as a place for "the continued evolution of human culture".

Soleri's design consists of a one-kilometre-high central tower, 500 metres wide at the base, surrounded by a double set of multi-level concentric exedra which contain a large spectrum of urban activities. The Sun is a primary agent in the design of the Hyper Building. The tower and the exedra are connected either by transparent or opaque membranes according to the seasons. These membranes are stretched from one exedra to the other and drape the southern edge of the tower. The spaces between the exedra form a zone of acclimatisation between the outside and the inside where temperature, light, wind, and rain can be modified and moderated (See Plate 19 (b)).

> The self-contained, three-dimensional landscape... marks a clear distinction between nature and city, while putting nature at the "feet of the city" at a walking distance for residents and guests. The identity of the city, whatever the originality it might develop, would have a powerful signature in its physical structure...The miniaturized and complex environment generated by the Hyper Building is a definer of frugality, the same frugality impossible in the scattered mode of suburban sprawl now embraced by the hyper-affluent societies. Frugality is the vessel for interiorization and life, the whole of it, is interiorization.[134]

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[132] In 1994 the Japanese government formed the Hyper Building Research Committee (HBRC) as a joint research organisation with the support and co-operation of the Japanese Ministry of Construction. The Committee is charged with adopting policies to make possible the construction of a hyper building. Soleri was one of three architects invited to develop design proposals. The others were Rem Koolhaas and Nobuaki Furuya.

[133] Hyper Building Research Council Committee (Home Page, 1997) <http://www.cyber-bp.or.jp/hyper/>

[134] The Hyper Building by Paolo Soleri (Home Page, 2000) <http://www.arcosanti.org/arcology/hb/index.html>

Together the tower and the exedra house a permanent population of 10,000 and a daytime, commuting population of 140,000. Eight multi-level neighbourhood "terras" (or "artificial grounds") within the tower comprise of open spaces that include parks, community and cultural places have their own micro-climate and give residents "breathing space" and provide a human scale to the mass of the tower. Midway up the tower a large, multi-level ""park terra" is developed into a greenhouse, similar to the Biosphere II project in Tuscon, Arizona.[135] Since various activities are juxtaposed and overlapping within the three-dimensional structure of the tower it becomes a layered sequence of focal points rather than a dispersed two-dimensional grid.

The Hyper Building provides 1044 hectares of space. Almost half of this is residential, formed in neighbourhoods between terras and in the exedra. Around 15 percent is commercial space, including shops, offices, restaurants, and production facilities. Five percent is reserved for administration, distribution centres and conference facilities. Another 5 percent is for the construction yards on the eight terras. Green space covers around 15 percent of the total area within the terras, the exedra, and within the areas surrounding the tower providing public streets and parks. Another 15 percent contain the "intermittent cultural zones" including schools, medical facilities, day care centres, theatres and art facilities. Around a third of the cultural area is designated as a "virtual reality recreational park" located within the bowels of the building, "disconnected from ecological reality" where "fantasy worlds can be developed three dimensionally in a totally controlled environment".[136]

The logistics of the building are based on separate provisions for people, goods and services. The site is located on a planned Mag-Lev transportation line in the Mojave Desert. A transport terminal located on the northeast side of the structure allows occupants to shift from the mass transit system to local and express elevators operating between the terras. A heliport with 38 landing pads is located at the top of the tower. Movement within the building is via pedestrian circulation, enhanced by elevators, escalators, moving walkways, and bicycle routes. Service transportation originates in construction yards, warehouses and distribution areas on each of the terras. Freight elevators handle construction materials and large goods. A 25,000,000 square metre underground car park, with spaces for 64,000 cars and 30, 000 commercial vehicles is located within a solar power generation plant. Although Soleri envisions that the cars will not be used on a daily basis he expects them to be used by residents for recreation and long-distance travel.

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[135] The Biosphere II Centre (Home Page, 2000) <http://www.bio2.edu/index.html>
[136] The Hyper Building (Home Page, 2000)

In terms of energy production and consumption the Hyper Building is semi-autonomous. While it remains connected to the conventional energy grid its dependency is reduced through a combination of active and passive alternative energy production[137], and by energy savings gleaned through the efficiency of the three-dimensional system. The design places emphasis on the pedestrian and would result in a radical reduction in the scale of fossil fuel consumption normally associated with an urban system of this size. The compact, three-dimensional, design ensures that residents are within walking distance of most activities while the multi-functional and integrated nature of the complex allows them to live, work and learn in a densely-packed, lively environment. Food production in the greenhouses contributes to the self-contained character of the habitat while further reducing the consumption of fuel normally associated with transportation.

The "garment architecture" defines both greenhouses (through transparent membranes) used to capture warm air, which is channeled through the building via convection, heating it on cold evenings and in winter, and parasols (through opaque membranes) to provide shade from the Sun during the hot summer months. The *chimney effect* defines the structure's ventilation system by taking advantage of rising warm air and sinking cool air.

8.9 Arcological economics and politics

Soleri's approach to arcology's economic and political system is intentionally vague and open-ended. While he actively discourages an economic system based on capitalism, suggesting that "there is more to life than economic solvency"[138] he assumes that arcologies will have a form of market economy based on *frugality*. Frugality, he believes:

> ...is a more effective and equitable path into the future [for] a planet with limited resources...Opulence is not only the privilege of parasites [but] also the *deux ex machina* of waste, destruction, [and] pollution.[139]

Soleri's organic metaphor supports his view that the city must exhibit frugal qualities. Organisms optimise efficiency in their use of resources to perform specific functions. Frugality ensures the balance between the organism's health and well-being and its supporting

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[137] 78,000 square metres of solar panels with photovoltaic cells are located at the top level of the exedra producing 1o megawatts of low voltage electricity per hour for use in low voltage lighting throughout the building. Windmills produce a further 10 megawatts. A field of solar power generators consisting of 5000 hydrogen conversion units are designed to take full advantage of the extended hours of sunlight, producing an estimated 175 megawatts per hour and meeting the bulk of the household electricity demands within the Hyper Building

[138] Soleri, *The Bridge Between matter and Spirit* (1973), p. 96

[139] *Ibid*, p. 217

environment. Equilibrium underpins the whole notion of sustainability. The fact that an arcology is intended to be semi-autonomous and self-reliant, producing much of its own food and energy means that it is better placed to sustain an economy of frugality. This frugal imperative is not only the basis of an arcology's economic system but it becomes a generative principle in its physical design. In a compact, three-dimensional structure, based on optimising performance in the most efficient way, there is no room for that which is superfluous.

Soleri does not prescribe what kind of economy will operate within an arcology. Economic forecasting, he says, is in any case full of uncertainties. "It is ...impossible for our economists and politicians to prognosticate what is going to happen the following year, let alone in the next century".

Soleri also professes to have no preconceived plans about how to organise the civic administration of arcologies. In a sense, he says, he is not even interested in this aspect of their development. As an architect he sees his role, in a traditional sense, as attempting to provide "shelter" to social and cultural institutions, not in trying to develop new political laws. He believes his task is akin to that of making a musical instrument, like a piano, and he distinguishes between the production of the "instrument", or a planning system, and the "music" that is going to be played on it. He is much more concerned about the performance of the instrument than the preferences or skills of the performer. He does insist, however, that society needs and seeks a truly urban instrument. An arcology, he argues, will generate a better economic and political system, because it is a better instrument.

While this metaphor is seductive, it does tends to disregard important aspects of the social production of the instrument - how the piano, for example, expresses the collective values and tastes of those people who invent and construct it. It requires a sophisticated and complex society to build a piano, and only a certain type of individual can develop the skills to play it well. To succeed, not only must it be designed and built but players need to be trained, concertos composed, concert halls built, and audiences educated.[140]

Soleri justifies the political vagueness and lack of definition by describing it as a virtue. In an arcology, he argues, the idea of integrating the three main components of life - living, learning and working is to create a system in which "planning the lives of the residents will be avoided". Excesses of legislation, laws, codes, norms, and restrictive practices would be shunned in favour of providing people with a "specific grid of environmental resources (an "instrument") within which to act and play out their lives (the "music").[141] He suggests that:

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[140] Luke, (1997), pp. 153-243
[141] Soleri *Arcosanti*, (1983), p. 46

> [City] dwellers do not realize that what they are missing is almost all of what they unconsciously seek: a friendly, blossoming urban life, not coerced into fringe performance by an obsolete layout,...bad logistics, the squalor of the laissez faire, [or] the economic imperative.[142]

Although he suggests that an overhaul of the political and economic order of society would follow on from the restructuring of the urban system , Soleri does not believe that he is qualified enough to describe what the political and economic landscape of such a society might be like. In refusing to be drawn into an economic and political quagmire he is essentially following the precedent established by other urban visionaries of the twentieth century, such as Howard, Wright and Le Corbusier, while leaving various possibilities open.

8.10 Responses to Soleri's work

Although the architectural establishment have had difficulty knowing what to make of Soleri he has been the recipient of a number of prestigious awards and honours granted by his professional peers since the 1960s. In 1963 he was awarded the American Institute of Architects (AIA) *Gold Medal for Craftmanship* for work done on the *Mesa City Project* (1958). He has been the recipient of various research grants and fellowships, both for his theoretical work on the arcology concept and for more practical research in ecological architecture, including those form the Graham foundation (*Mesa City,* 1962), the Guggenheim foundation (*Architecture as Human Ecology,* 1964 and *Arcology*, 1967) and the Xerox Corporation (*Two Suns Arcology: the City Energised by the Sun.* 1975). In 1976, in Vancouver, Canada, he was a principle speaker at the United Nations First Global Conference on Human Settlements: *Habitat I.* In 1977 he was presented with a Design Citation from *Progressive Architecture* for the design of the East Crescent Complex at Arcosanti, in Arizona. He received a Gold Medal at the World Biennale of Architecture held in Sofia, in Bulgaria in 1981 and a Silver Medal from the Académie d'Architecture in Paris in 1984. In 1989 he was awarded a Special Prize by the Congress on Utopia at the Universita Degli Studi di Genova in Reggio Calabria, in Italy. In 1996 he was made an Honorary Fellow of the Royal Institute of British Architects (RIBA).

Soleri has written ten books since 1970, has published numerous articles and chapters in books on subjects ranging from the design of bridges to environmental ethics, has organised eleven major national and international exhibitions of his work[143], and has lectured in countless

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[142] Soleri, *The Bridge Between Matter and Spirit* (1973), p. 97

[143] These are as follows: *Visionary Architecture,* Museum of Modern Art, New York (1961); *Two Urbanists: The Architecture of Buckminster Fuller and Paolo Soleri,* Braneis University, Waltham, Massachusetts (1964); *The Architectural Vision of Paolo Soleri*, Corcoran Gallery, Washington, DC (1970); *2 Suns Arcology: The City Energized by the Sun*, Xerox Centre, Rochester, New York (1976);

universities around the world. He has taught for many years at Arizona State University, where his silt-casting architectural workshops have been accredited since 1964. He has also received Honorary doctorates from Dickinson College in Pennsylvania, Moore College of Art in Philadelphia, and Arizona State University.

The public reception to Soleri's ideas has changed over the last thirty years or so, broadly reflecting significant shifts in the focus of his work. The post-war economic and population boom in the United States created a wave of optimism and confidence in the future that encouraged a rash of building construction and the outward expansion of American cities via the accelerating process of urbanisation supplemented by suburban sprawl. By the early 1960s, just as the impact of this growth process was beginning to become apparent, Soleri began to publish his urban and philosophical ideas, along with his built works and early exhibitions. Due largely to the publication of, *Arcology: The City in the Image of Man* (1969) and the national travelling exhibition, *The Architectural Vision of Paolo Soleri* (1970) which opened at the Corcoran Gallery in Washington D. C., and his work started to attract the attention of the general public, the media, and academics alike. The exhibition, then the largest of its kind, attracted hundreds of thousands of visitors. Soleri was highly praised by the popular press. When his theoretical work was increasingly being cited by a diverse group of academics and architectural critics (Cook, 1969[144]; Huxtable, 1970; Moholy-Nagy, 1970[145]; Kostof, 1971[146]; Skolimowski, 1971; and Sharp, 1972[147]) his appearance was described by Reyner Banham as "ascetic enough to be an early Renaissance John the Baptist, even in frayed shorts and a stone mason's grubby singlet".[148] Ada Huxtable, in a review in the *New York Times* (1970), suggested that he was dealing with "the natural and man-made world, in a very special mutual relationship".[149]

For Soleri urban sprawl remains the 'utopian dream'. It doesn't work 'because it is endless matter which is flat, amorphic, tenuous. It creates "the myriad of the golden cages, the place where the ecological suicide of the wealthiest nations in history goes on, it is the place for non-action that stands suspended between intensity and naught...the place for hibernation and

Envision Cities of the 21st Century, Miami-Dade Community College, Florida (1980); *Utopian Visions in Modern Art,* Hirshhorn Museum, Washington, DC (1983); *Yesterday's Tomorrows,* National Museum of American History, Washington, DC, (1984); *Space for Peace: Architektur Vision,* Graz, Austria (1984); *Space Models,* Union of Architects, Moscow (1989); *Paolo Soleri Habitats: Ecologic Minutiae,* New York Academy of Sciences ; and *Cities: Architecture for Planet Earth and Beyond* (Cosanti Foundation, Scottsdale, Arizona (1994)

[144] J. Cook, 'Paolo Soleri' in *aaq* 1 (1969), pp. 216-223

[145] S. Moholy-Nagy, 'The Arcology of Paolo Soleri' in *Architectural Forum* 132, (1970), pp. 70-5

[146] S. Kostof, 'Soleri's Arcology: A New Design for the City' in *Art in America* 2, (1971), pp. 91-5

[147] D. Sharp, 'Soleri: The First Arcologist' in *Building* 223 (1972), pp. 75-82

[148] Monczunski, (1998-99)

[149] A. L. Huxtable, "Prophet in the Desert' in *New York Times Magazine* 2 (1970), p. 26

desensitization".[150] His alternative proposed structures containing populations of millions and leaving the rest of the Earth as wilderness. Initially many radical environmentalists were sympathetic, because the arcology concept seemed to "quarantine (destructive) humanity from (life-giving) nature".[151] Certainly in his work, derived for his doctoral research in "architecture as human ecology", Soleri spoke of ecological principles of 'community' and 'ecosystems', of the need for 'equilibrium', the importance of 'habitat' and 'energy efficiency'. The alternative lifestyle community that he advocated conformed to the minimum criteria for being green (Table 5.1) and to the basis of a green political agenda. but through the strong anthropocentric current that runs through all of his writing Soleri has made it consistently clear, that his priority lay in the arrangements of human life within the urban structure. Here within a "neonature" he sees a new stage of human community evolving and insists that:

> When it becomes fashionable to discredit "man" and to proclaim the felicity of a nature freed from his presence, we insult nature and man both. We are part of nature, but we seek that which nature cannot yet deliver: equity, compassion, the work of the mind. Part of the technology of transcendence is the action of the *homo faber* When need be, such action must define a neonature, a "divine" component to an albeit astonishing process, the evolving cosmos.[152]

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[150] Soleri, *The Bridge Between matter and Spirit* (1973), p. 18 and p. 233
[151] Le Gates and Stout, (1996), p. 453
[152] Soleri, *Arcosanti* (1983), p. 58

9

The Arcosanti Laboratory

Chapter 9

9.0 THE ARCOSANTI LABORATORY

If it is true that there are structural priorities that every civilisation must define for itself, then to make sense out of our physical environment has a very urgent call for priority. Macro-Cosanti will be a testing ground for environmental concepts that seek coherence between aims and ends. Macro-Cosanti will apply arcological concepts. I call it Arcosanti, and we are now actively working at the initial phase.[10]

Figure 9.1 Arcosanti: East Crescent under construction, 1999

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[10] Soleri, *Arcology* (1969), p. 120

9.1 A new urban setting

On top of a low mesa above the Agua Fria river, in the central Arizona desert 70 miles north of Phoenix, *Arcosanti,* a unique laboratory devoted to testing a new ecological alternative to the modern city, has been developing slowly over the last 30 years. A project of Paolo Soleri's Cosanti Foundation, Arcosanti is a working prototype for a new kind of city, one that is being designed, built, and inhabited as a three-dimensional, highly concentrated urban structure. Described as a "permanent experiment in urban intensity"[2] when complete it will house an environmentally benign "learning/doing" community of five to six thousand people, occupying only fifteen acres of land in the midst of an 860-acre nature preserve containing orchards, agricultural fields, canyons and high desert hills. The compact structures of Arcosanti, which face the sun to gather its energy, will stretch no more than quarter of a mile on any one side, but they will rise to as much as thirty stories tall. Inside the structures will contain the economic, cultural, and social infrastructure normally scattered around the modern city, while providing residents up to two thousand square feet of living space per family. A series of orchards would line the north side of the structure, creating a unique fusion of urban and agricultural environments. Outside there would be expansive views of another three thousand acres, leased from Arizona State, to be kept as undeveloped open space. An integral part of the design will be five to seven acres of south facing sloping greenhouses, an "energy apron" acting as a central system for producing food and collecting energy to support the prototype town (See Plates 20 and 21).

Since 1970 Soleri has used Arcosanti to rethink the totality of modern urban design and planning. Instead of accepting the logic of two-dimensional cities, and what he sees as the inherent wastefulness of suburban sprawl, he has developed Arcosanti as a laboratory to explore the idea of urban "implosion", where the city infrastructure contracts and intensifies in order to become more efficient, ecological, and sustainable. Soleri believes that cities can be designed in such a way that the vitality of urban life can be increased, without destroying the surrounding environment that sustains the habitat. The *arcology* concept from which Arcosanti derives, bans the motor car from operating within the city in favour of pedestrian walkways aided by fixed mechanical people movers (lifts, escalators, and moving walkways). Because of the compact nature of the urban structure, most journeys by foot would take around fifteen to twenty minutes (about the same time as it takes typically to walk from inside a shopping mall to the outskirts of the car park in cities like Phoenix and Los Angeles). The "controlled implosion" at Arcosanti

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[2] I. Altman and M. M. Chemers, *Culture and Environment* (Cambridge University Press, Cambridge, 1980)

would stabilise the community at around 350 people per acre – ten times the population density of New York City.

Now listed on the state map of Arizona, Arcosanti is now officially a small town. As such it is faced with the challenges of daily existence but, at the same time, its aim is firmly fixed on the future. By trying to anticipate it and attempting to plan for it, Arcosanti strives to keep the road to the future open, while recognising that paradise here on earth can only ever be an imaginary condition.

9.2 Soleri's ecological architecture

Ecological design is defined as "any form of design that minimises environmentally destructive impacts by integrating itself with living processes".[3] It explicitly addresses the design dimension of the environmental crisis and involves the effective adaptation to and integration with nature's processes. According to Van der Ryn and Cowan (1995) ecological design offers three critical strategies for dealing with the depletion of the Earth's natural resources: involving issues of *conservation*, *regeneration* and *stewardship*. Conservation slows the rate of the problem down by allowing scarce resources to be stretched further but it cannot lead to sustainability because it continues to imply resource deficit. Regeneration involves the repair and renewal of a world deeply wounded by environmentally insensitive design. It not only preserves but restores and amounts to an expansion of natural capital through the active restoration of degraded ecosystems and communities. Stewardship requires a quality of care in our relation with other living beings and with the natural landscape, with careful maintenance and continual reinvestment.

Some argue that Paolo Soleri's architecture is a 'parody' of Wright's in the sense that his building are an organic outgrowth of its site but to Soleri Wright's prairie houses represent a "spurious and superficial way of being 'in sympathy with nature"'.[4] Soleri's architecture has long embraced the notions of conservation, regeneration and stewardship within ecological design. His arcology concept is premised on the kind of reduction of energy and material flows that would allow human communities to be re-integrated within their surrounding ecosystems. Arcosanti is growing out of a specific context and a real place that presents the design constraints for the project. In the two years directly following his departure from Taliesin, at a camp site in the desert, Soleri collaborated with another of Wright's apprentices, Mark Mills, on the development of a specific construction method in proposals for a series of earth house

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[3] S. Van Der Ryn and S. Cowan, *Ecological Design* (Island Press, Washington, D.C., 1995)
[4] Soleri cited in Ostler, (1994), p. 12

designs.[i] This early work still informs Soleri's approach and through the years he has attempted to respond to Wright's critique of 1948 and tried to create an architecture '*of* the earth' by setting his buildings into the ground rather than on it.

9.2.1 The cave creek dome house

Shortly after his design for the *Beast Bridge* had been published, alongside one of Wright's, in Elizabeth Mock's *The Architecture of Bridges* (1948)[5] Soleri and fellow apprentice Mark Mills set up a camp, a few miles from Taliesin. They collaborated on a commission for Leonore Woods, the Cave Creek *Dome House* (1949), a partially subterranean building with a glazed dome section over the living area, incorporating a passive heating and cooling system ideally suited to the extremes in temperature experienced in Sonoran desert (see Plates 1 & 2). No doubt partly in response to Wright's critique the *Dome House* was, very much '*of* the plateau', being submerged into the desert landscape. Reputedly when he visited it (in some ways similar to his own bermed house in Wisconsin) Wright wandered around pointing out which details were based on his ideas.[6]

Now registered as a historic landmark in the state of Arizona the building has two main areas, the living area and the sleeping area, are spatially connected to exploit the topography of the site and the thermal inertia of a structure embedded in the earth. The main living area is located directly below the glazed dome section, which was built in two halves (one with transparent and the other opaque glazing), which rotated on tracks allowing the dome to be either fully or partially opened. In this way the temperature inside the living space could be modified quickly to react to the external environment. The sleeping space is below the ground line, and constructed of concrete embedded with natural rock. The space reacts more slowly to any fluctuations in external temperature above ground and the thermal mass means that the walls slowly warm up throughout the day and gradually loose their heat during the night. The house was in effect a passive solar energy device.

The method of construction and approach to thermal comfort employed at the *Dome House*, and the extensive use of concrete both externally and internally, made it unique in many ways, and considering its period it is hardly surprising that it was cited in Henry Russell Hitchcock's and Arthur Drexler's *Built in the USA: Post-War Architecture.*

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[5] E. Mock, *The Architecture of Bridges* (useum of Modern Art, New York, 1948)
[6] '25 Years of Arcosanti & Arcology: The Works of Paolo Soleri' in *Heartland Journal* (1996) at www.pg. net/users/c/charconet/heartland-arcosanti.htm

9.2.2 Ceramica artistica Solimene

In 1950 Soleri returned to Italy, where they toured around in a self-built caravan with a water tank on the roof to provide naturally heated water for their shower, and supported themselves by selling ceramics which Paolo designed and made. They travelled to the small town of Vietra sul Mare on the Amalfi coast to visit the ceramics factory owned by the Solimene families. A mutual interest in ceramic techniques led to Soleri's commission to design a new larger factory, the *Ceramica Artistica Solimene* (1951-2) his only built project to date outside of the United States . Built on a steep and constricted site Soleri's design followed the process of ceramic production by placing the various stages, from the delivery of the clay at the top level to the final packaging of the green-glazed ceramic pots, along a continuous ramp. Like Wright's Guggenheim Museum (1944-57) in New York, the ramp descends five storeys around a central sky-lit atrium. Both the ramp and roof are held up by angular tree-like reinforced concrete supports.

The form of the structure allows light to descend through the central well of the building but also allows for the definition of a series of smaller, more private spaces, shaded form the sun, where individuals can get time away from others to concentrate on their own work. The optimal use of the sun for both practical and aesthetic purposes is a dual theme that Soleri has continued to develop in the buildings at Arcosanti. *Building Design* featured *Ceramica Artistica Solimene* in 1984 when it reported that the building's:

> ...architectural qualities lie mainly in the structure and in the handling of light. The architectural element is intrinsic rather than applied, and ornament assumes as much a signifying as a decorative function to give clues on the façade as to the nature of the products sold and made inside. It is by no means an overbearing building but its architect has not failed in his responsibility to produce a work of art.[7]

Set against the high undulating cliff that forms its immediate context the main scalloped façade clad with 36,000 green ceramic pots set in cement and punctured by square metal windows on the diagonal, give the building a reptilian appearance and recall Gaudi's Expressionist structures at Guëll Park. But the external form and appearance of the building is in keeping with the clay manufacturing process and the general characteristics of the region. Its striking apparently futuristic form is tempered by its vernacular use of faience in an abstract manner that echoes the dome of the local church.[8]

In what has become the norm for Soleri's executed works, economic constraints meant that the construction work was carried out by unskilled workers (the factory's own employees), rather

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[7] J. Loach, 'Clay Pot Construction' in *Building Design* (March 16, 1984), pp. 18-19

than by outside labour and rough formwork was used for casting the concrete. *Ceramica Artistica Solimene* took a year and a half to complete but fifty years after its construction, it is still owned by the same family, and is still functioning as the largest ceramics factory in the region.

The work on *Ceramica Artistica Solimene* consolidated Soleri's interest in the ceramic production process, an interest which would lead eventually to the production of the ceramic and bronze wind bells and chimes. These have helped to fund Soleri's experimental construction projects and their production has formed the basis of the working culture at Cosanti since the 1950s and Arcosanti since the 1970s.

9.3 The experimental buildings at Cosanti

In 1955, Soleri and his wife Colly, bought five isolated acres of land in Paradise Valley, just outside Phoenix (about fifteen miles southwest of Wright's Taliesan West) and, a year later established the Cosanti Foundation, a non-profit organisation dedicated to pursuing the research and development of an alternative urban environment. They began workshops experimenting in the construction of a series of earth structures, based on the same techniques used in casting ceramic artifacts:

> I began working with earth and silt in the 1950s. Originally I became interested in using the desert soil and the silt abundant in the dry Arizona river beds because of their inherent properties and availability. Experimentation proved the usefulness of earth and silt as molding materials as many types of crafts projects. Clay and plaster were the first materials that we cast in earth and silt molds. We produced ceramic windbells from earth molds, and plaster architectural models from originals, which had been carved in silt. The use of earth and silt for making forms on which to cast concrete was the logical next step.[9]

From 1956 to 1974, ten of the structures at Cosanti (the *Earth House* [1956]; *Ceramics Apse* [1958]; *North Studio* [1961]; *Metal Studio* [1964]; *Pool Canopy* [1966]; *Pumpkin Apse* [1967]; *North Apse* [1964]; *Cat House* [1965]; *Student Apse* [1968]; and the *Antioch Building* [1974]) were "earth-cast" using silt-casting methods and involving architecture students in Siltpile workshops throughout the 1960s.

The result is a complex of buildings that are used as craft studios, a foundry, work areas, offices and residences (see Plate 22). Soleri describes the Cosanti complex as a combination of "ancient craft techniques, new variations on these techniques, scrounged and donated materials, aesthetic perceptions, unorthodox architectural concepts, and the sweat of many workers".[10]

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[8] *Ibid*
[9] P. Soleri and S. Davis, *Paolo Soleri's Earth Casting* (Peregrine Smith Books, Salt Lake City, 1984), p. 2
[10] *Ibid*, p. 4

9.3.1 The silt-casting method

Silt-casting, derives from an ancient craft and involves the use of a very fine type of earth, called silt, to make moulds and forms for the casting of various materials. Since silt has a homogenous quality it can be used for moulds that can be made into almost any shape allowing for the casting of a large variety of shapes and forms using different kinds of materials, including clay, plaster, wax, and concrete.

At Cosanti since the 1950s Soleri has used the silt-casting technique to produce a number of craft items using earth, silt and plaster moulds, including architectural models and the, now famous, bronze and ceramic wind-bells.

9.3.2 The earth house

The unusual viscous property of the desert sand, and its abundance in Paradise Valley, gave Soleri the means to explore, what Victor Papanek (1984) describes as a "a radically new building method". The method is simple. In *Design for the Real World* (1984) Papanek describes how the technique was adopted for the first structure to be built at Cosanti, the *Earth House* (1956):

> Selecting a mound of desert sand, Soleri criss-crossed it with V-shaped channels cut into the sand, making a pattern somewhat like the ribs of a whale. Then he poured concrete in the channels forming, when set, the roof beams of the house-to-be. He added a concrete skin for the roof and bulldozed the sand out from underneath. He completed the structure by setting in car windows... from automobile junkyards.[11]

The spaces within the *Earth House* are arranged around a central unit of services, cooking and bathroom. For Papanek, the method of its construction represents a *'tour de force'* in its "creative and honest use of tools, materials, and processes".[12] The earth and silt-casting technique has been used widely at Arcosanti since 1971.

After *Mesa City* (1958) which was a relatively two-dimensional urban environment Soleri developed a more self-contained three-dimensional structure which he called *Cosanti II* (1962), the forerunner for Arcosanti, Its overall structure and appearance at this time reflected both Soleri's pre-occupation with the idea of miniaturization and his experimentation with the apse form. The apse shape as adopted by Soleri adopts a south exposure in a Northern Hemisphere to shade itself in the summer and cool itself in the winter. Using concrete as the primary building material allows for durability and heat sinking (the accumulation of heat within the structure).

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[11] V. Papanek, *Design for the Real World: Human Ecology and Social Change* (Thames and Hudson, London, 1984), pp. 9-10

The benefits and limitations of the *apse effect* as both a solar device and spatial enclosure had been explored at Cosanti since 1963 in early "earth-cast" (or "siltcast") structures including the *North Apse* (1964), the *Pumpkin Apse* (1967), and the *Student Apse* (1968).

9.3.3 The north apse

The *North Apse* is a silt-cast concrete shell about 6 metres high in the shape of a quarter sphere ("bandshell"). It was the first of Soleri's structures to use the apse shape to allow the structure to act as a passive solar device, receiving the low winter sunlight and blocking the sun's high summer rays, The construction involved the casting in place of eleven individually reinforced panels in a sequence. It adopts the Roman arch as a basic model for its engineering and construction method, where each separate section effectively leans on the others and the top piece acts as a keystone. The *North Apse*, the first structure to be completed by the summer Siltpile Workshop students from Arizona State University in 1964, forms the main entrance to the working spaces at Cosanti.[13]

9.3.4 The pumpkin apse

A large mound of earth was piled up and then shaped and carved with ribs and facets by hand to form the mould. At the top of the mould a timber form supported a concrete collar above a fluted skylight. Various colours of pigment were painted onto the mould in certain places to give a polychromatic effect on the underside of the completed apse. Concrete was then poured onto the mould, and allowed to cure. Finally the earth was dug out from under the concrete shell by hand leaving the structure intact. The *Pumpkin Apse*, along with the *Barrel Vaults* (1971 - cylindrical buildings resting on the ground built of concrete conduits and timber cross-ties) house the Cosanti Foundation's offices (see Plate 23).

9.3.5 The student apse

The same process was used to form the basic mould for the *Student Apse* but this time the earth was refined and carved in horizontal sections in sequence. Each section could then be poured and cured independently in a sequence as that part of the mould was completed. The first layer of concrete was poured onto the top section and overlaid with reinforcing bars. The section below, which included the chimney, was formed next, and so on down the structure.

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[12] *Ibid*
[13] Soleri and Davis, (1984), pp. 80-3

Horizontal and vertical groves were carved into the mould to form ribbed panels on the inside of the apse. The 'Student Apse" derives its name from the students who built it during a Cosanti summer seminar. Each participant created their own individual designs on the vault panels formed by the ribbed pattern. These were cut from waxed paper, which was tacked onto the earth mould acting as masks when the concrete was curing. The process created grey patterns against the brown of the earth-cast concrete interior and gave the apse its distinct character.[14]

9.4 The buildings at Arcosanti

In *Arcology: the City in the Image of Man* (1969), Arcosanti was the 30th, and last, of the arcologies to be presented. In the book Soleri describes it as a "self-testing school in urban studies" which aims at the "betterment of man's condition and in conservation of nature, inasmuch as they both depend on the creation of efficient and humane cities". Because of the "physical, cultural, and ethical impasse" that he believed society had reached he proposed the investigation of new urban patterns and structural systems within the construction of a complex that would apply and test these at the modest end of the urban scale.[15]

Arcosanti's guiding parameters are those in which the city is viewed as a "biomental organism" of a "thousand minds". The contraction of the urban container is seen simply as a response to the enormous forces of complexification at work within the social organism. From the outset, since many of the activities were to be developed in "sheltered -but-open spaces", the main physical problem was how to "tame the sun by selecting those radiations that are 'kind' and rejecting those a that are 'unkind'. [The Sun's] curved trajectory demands curved traps".[16] The apse form has characterised Arcosanti's appearance ever since its inception, the "curved trap" idea having influenced the design of many of the buildings now completed. What exists at Arcosanti today is a cluster of various structures and spaces, the highest rising to five storeys, which cling to the edge of a south-facing mesa (see Plates 24 & 25). These are the *South* and *North Vaults* (1971-75); the *Ceramics Apse* (1972-73); the *Foundry Apse* (1972-74); *East Housing* (1972); *West Housing* (1973); the *Crafts III Building* (1973-77); the *Lab Building* (1976-77); the *Colly Soleri Music Centre* (1983); the *East Crescent Housing* Units 1, 2 and 3 (from 1975) and the *East Crescent Amphitheatre* (1975-89), the *Soleri Office Drafting (SOD) Unit, Library and Office Greenhouses* (1975-87); and the *Swimming Pool* (1974/78).

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[14] *Ibid,* pp. 84-6
[15] Soleri, *Arcology* (1969), p. 119
[16] *Ibid,* p. 121

Construction work at the Arcosanti site began in 1971 and the construction of the first main structures involved extensive silt-casting using the silt from the Agua Fria River bed that runs throw the land. Unlike the buildings at Cosanti, those at Arcosanti are mostly constructed above ground using a similar, but more sophisticated earth-casting technique. Arcosanti's concrete structures are either cast-in-place or pre-cast using one, or a combination of three basic techniques:

- pre-silt-cast curved panels;
- pre-silt-cast flat;
- cast-in-place on scaffolding.

Much of the construction at Arcosanti has utilised pre-siltcast concrete panels with steel plates on the edges as part of the reinforcing. Once the panels are fitted onto the various structures the edges are then be welded together.[17]

9.4.1 The south and north vaults

Begun in 1971, the *South Vault* was the first structure to be built on the mesa at Arcosanti and the first of two adjacent structures, which together form the *Main Vaults* (see Plate 26). The *North Vault* was built in 1975. These are two arched concrete shells, open to the north and south, which act as a large, covered, multi-use area. Each vault is 9.5 metres long, 28 metres wide, and 11 metres high and covers around 2300 square metres of floor space.

The construction of each was similar. Foundations were laid using conventional methods to support curved beams at either end. These were pre-cast in sections at ground level and then lifted into place to form a frame to hold twelve individually pre-siltcast curved panels. Designs were applied to the silt using liquid concrete pigment and rubber stencils. Since, when it is curing the concrete takes an almost photographic impression of whatever material it is cast against, it can absorb colours, patterns and designs made on the silt prior to pouring (see Plate 27). Patterns for circular windows were made out of wood and placed in the appropriate places on the silt moulds. When the casting process was complete the panels were lifted into place by a crane.[18]

9.4.2 The ceramics apse

The *Ceramics Apse* has a 7 metres radius shell that covers a 325 square metre floor area. The construction, that took place between 1972 and 1973, was similar in some respects to that of

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[17] Soleri and Davis, (1984), p. 93
[18] Ibid, pp. 94-6

the *South Vault,* in that the arched concrete frame that forms the buildings façade was pre-cast on the ground and then lifted into place, to provide support for the siltcast shell that was then constructed on a wood and steel scaffolding system. Nine coloured concrete discs, which would become decorative details on the inside of the completed apse, were pre-cast and placed on the formwork before the concrete was poured. After it had set, the scaffolding and plywood were removed, and the silt dug and washed out.[19]

As a small scale example of the *urban effect,* the structure functions as ceramic studios, a stage for music and dance, and a small amphitheatre for tour guides, performances and presentations. The *Ceramics Apse* also exhibits the *apse effect* as a "passive solar machine" where shading can produce a summer daytime temperature differential of 15°F cooler, and in the winter, the temperature can be as much as 15 - 20°F warmer inside the apse (see Plate 28).[20]

9.4.3 The foundry apse

The construction of the *Foundry Apse* followed the same method as that of the Ceramics Apse and since it also has a 7 metre radius shell the same template system was re-used to cut the silt to the correct curvature and the same ribs used to hold reinforcement bars and articulate the structure of the shell. Concrete pigments were then painted onto the silt. The Foundry Apse covers an area of 465 square metres, which also includes rooms that were built around the rear perimeter of the apse to provide accommodation for foundry workers. Arranged symmetrically in pairs and half-buried into the ground these have a folded roof structure, which was siltcast in - place at various heights to articulate the different spaces inside.[21]

Bronze wind bells are cast in the foundry using a method called 'split form moulding', an ancient technique for creating sand moulds into which liquid molten metals, in this case at a temperature of between 2,000 and 2,400°Faranheit, can be poured. Once poured the metal solidifies almost immediately and, when sufficiently cooled the sand block can be broken open and the bells cleaned. The hot air rising from the furnace is channelled from the hood along a tunnel, which runs around the rear of the apse ceiling. Heat energy exchanges through the structure and radiates into the rooms behind. Water pipes on the front of the apse direct rainwater from the roof to cisterns at ground level. This is intended as a source of irrigation for the greenhouses (see Plate 29).[22]

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[19] *Ibid*, pp. 99-101
[20] Arcosanti Residents, 'The Ceramics Apse' (Unpublished Cosanti Foundation Paper, 1980)
[21] *Ibid*, pp. 101-3

9.4.4 East and west housing

These two structures are connected to the *South Vault* on the east and west sides. They are mirror images of one another, and were constructed employing the siltcast in-place technique for their curved ceilings similar to the vault panels and the *Ceramic* and *Foundry Apses*. The pre-silt-cast method was adopted to construct the oddly shaped wall panels for the north and south façades. These were lifted into place with a crane.

Each of the houses are around 9 metres wide , 15 metres long, and 6 metres high These two wings are currently the largest housing units at Arcosanti, although in the *SuperCritical Mass* proposal these simply form the links between the two larger residential areas in the *East and West Crescent Complexes*. The circulation is provided by external staircases at the ends of the buildings. At *East Housing*, the first to be completed in 1972, the stair gives access to the *Sky Suites* - raised apartments with views over the surrounding desert (see Plate 30). The *West Housing* staircase allows access to the roof of the *South Vaults*.

The south entrance to both *East and West Housing* is an adaptation of the *apse* and *greenhouse effects,* where the large eight-panelled windows hung like doors, can be closed in winter to create a sun space at the front of the house allowing for the passive radiation of heated air into the internal communal living space. These are swung open during the summer months to help ventilate the structure. Balconies above gather rainwater. When it reaches a certain level this empties into cisterns below and is used to water the gardens at the front of the house.[23]

9.4.5 The crafts III building

The *Crafts III Building* has perhaps the most conventional form of all the structures at Arcosanti the yet is the best practical example to date of arcology's principles of integration, three-dimensionality and complexity operating within a single structure. It is located at the most western edge of the site and visitors enter Arcosanti across a bridge into the building at an upper level. It is a multipurpose, multi-storey complex housing residential, commercial and recreational activities including single apartments, family apartments, a bakery, a café and restaurant within an atrium space with terraces that look south over the valley and east across the site (see Plate 31), a gallery exhibiting Arcosanti products including the Soleri wind bells produced in the Ceramics and Foundry Apses, and an where visitors gather around a model of *Babel Canyon* (1969) to discuss the arcology concept prior to being taken on a tour of the project. The name "Crafts III" is taken from Soleri's 1973 book *The Bridge between Matter and*

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[22] Arcosanti Residents, 'The Foundry Procedure' (Unpublished Cosanti Foundation Paper, 1980)
[23] Soleri and Davis, (1984), pp. 104-5

Spirit is Matter Becoming Spirit in which he describes humanity's three basic needs as "food, living and the arts". The foundations for the building were dug by hand in 1972, then construction primarily using the pre-siltcast flat panel method carried on until its completion in 1977.[24]

9.4.6 The lab building

Located at the north end of the *North Vault*, in what will eventually be the main access to Arcosanti, is currently a covered work site for the wood and metal workshops, called *the Lab Building*. Built between 1976-7 it is an example of "tilt-up" construction, typically used for industrial buildings where the enclosure of a large space is needed quickly and economically. The walls are pre-siltcast flat panels, which were welded in place. The ceiling and the upper floors (designed as offices or craft studios) were poured in place over formwork, tying the structure together and providing it with integral strength. The interior is trussed and has large skylights.

The building utilises a very basic form of passive solar energy. The laminated glass ceiling is whitewashed in summer to provide shading and cooling. In the autumn the whitewash is removed and the sun penetrates the glass warming the air inside as well as heating the exposed concrete surfaces. The *heat-sink effect* means that the heat is retained and collected by the structure during the day and radiates into the building by late afternoon and in the evening. The interior remains at a reasonably constant 60-65°Faranheit during the winter days.[25]

9.4.7 The Colly Soleri music centre and east crescent amphitheatre

The music centre was founded in February 1982 in memory of Colly Soleri. As a small indoor theatre, conference and concert venue and practice rooms for resident musicians. The extrados of the backstage on the roof of the building is designed as a *Sky Theatre* complete with concrete columns acting as the structure for *garment architecture.* Completed in 1990, this space at the centre of the *East Crescent* is used for various kinds of activities and performances. Since the completion of the seating and the installation of the temporary roof, the 500-seat venue it has hosted a number of events including the first "Minds for History" conference in 1989 and the "Paradox" conferences in 1997 and 1999. Eventually a canopy supported by the surrounding housing units will provide shade to the amphitheatre (see Plates 32 & 33).

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[24] Arcosanti Residents, 'Crafts III' in *The Visitor Centre Tour Guide* (Unpublished Cosanti Foundation Papers, 1988)
[25] Arcosanti Residents, 'The Lab Building' in *The Visitor Centre Tour Guide* (1988)

9.4.8 East crescent housing

In total *East Crescent Housing* comprises ten residential units, each of around 250 square metres of usable floor space, provide living and working accommodation for up to 60 residents, were planned within two large concave residential components that enclose the *East Crescent Amphitheatre* (see Plate 32). Service areas are connected and symmetrically arranged around the axis of the *Colly Soleri Music Centre* that forms the circulation path leading to the amphitheatre and the *Sky Theatre* beyond. The units are programmed vertically with studio space on the ground floor, shared living space on the first floor, and leased apartments on the second floor. The ground floor studio spaces are seen as semi-public spaces for craft workshops and display areas. This portico and work area acts as a spatial boundary between the living and performing aspects of the complex. Soleri believes that the inclusion of these studios enhances the *urban effect* and could help lead to the recognition of Arcosanti as a community in its own right.

Today half of the crescent has been constructed and seven of the units have been occupied since 1994. Co-housing is located on the first floor and is available for both individuals and families with shared facilities. The second floor spaces are subdivided into 1 to 2 person apartments with separate facilities. While the formal access is via a public walkway to the rear of the complex there are also semi-enclosed shared balconies at the front (see Plate 33).

Solar power is advocated in Arcosanti on a community wide scale. The housing units at the East Crescent are designed to have their heating provided by the *energy apron* and their hot water supplied by an active solar hot water system. Hot air is to be drawn up from the greenhouses on the south facing edge of the mesa below and into a heat tunnel that wraps around the rear of the crescent with openings into each of the residential units, under the first floor. In the winter the building is 'fed ' with warm air during the day which is stored in the structure and keeps the units warm during the night. In the summer nights the warm air absorbed during the day is ventilated to the outside. This *heat duct tunnel* also serves as ducting space for all electrical, water supply, sewage and storm drainage. Hot water is provided by centrally located gas-fired boilers. This allows for the future use of solar panels for pre-heating. Storm water is collected from the roofs in basins to be used in the *energy apron*.

9.4.9 The east crescent complex

The *Colly Soleri Music Centre*, the *Sky Theatre* and the *East Crescent Housing* and *Amphitheatre* together constitute the *East Crescent Complex*, which exemplifies and emphasises the mixed-use concept proposed by the arcology theory (see Plates 32 & 33). At its most intense

the *East Crescent* complex, which was given a *Progressive Architecture* award in 1979, will be an urban enclave steeped in living, making, learning, performing and exhibiting. It is designed as a place where the performing arts and group activities will produce music, plays, dance, recitals, conferences, and celebrations. Most of these activities will take place on the stage surrounded by three-storey houses. Placing the emphasis on housing provides the mixed-use notion with a different accent. Because the living and working spaces physically focus on the performance area residents are able to experience an environment largely dedicated to the arts (and more conducive to *esthetogenesis*).

9.4.10 Soleri office drafting (SOD) unit, library and office greenhouses

Situated on the eastern edge of the East Crescent complex is a hybrid building accommodating the studio, drafting room and model-making workshop. Begun in 1975 the west ground floor consists of a few small offices as well as the library and archives and a lecture /meeting room. At the east end of the unit an open plan drafting area sits underneath a greenhouse which is heated by means of a passive solar system. The drafting area can be opened, via large sliding doors onto to a small, enclosed garden to the north-east. Overlooking the drawing area is Soleri's own studio and apartment, completed between 1980-82.

9.4.11 The swimming pool

Set into a plateau of basalt rock, downhill from the *(SOD) unit,* which at one time held a basin of water, there is now an open-air swimming pool, excavated in 1974. This is used by residents to cool off during work breaks on hot summer days and as a venue for pool parties. The rocks above act as an unofficial diving platform. A small circular kids pool sits alongside on the west end of the concrete terrace.

9.4.12 La loggia

Housing units are to be included as part of the *energy apron. La Loggia* was designed as a four storey, 27 unit apartment building to be used as a guest facility for visitors. The roof of the stuccoed masonry structure is level with the swimming pool deck. Large silt-cast panels cap the vaulted third floor ceilings, while the lower level units will incorporate a frieze consisting of silt-cast modules produced, by students, visitors and guests. The foundations for *La Loggia* (Phase 1) were dug in 1990. A further phase includes the construction of the first one-acre section of the tiered south facing greenhouses, which will provide the source of heating to the apartments and

the *East Crescent* complex. Cross-ventilation between balconies and corridors will cool the internal spaces.

9.5 Unfinished business at the urban laboratory

Like Raymond Williams (1973), Paolo Soleri has long been convinced that humankind is in the midst of a transition into an urban form of global existence, but that the kind of thought that needs to be invested in our urban future has, in many ways, not even begun. He argues that technology, politics, economics, sociology, or religion alone cannot provide the framework of imagination that we need to move closer to a sustainable urban future. However by focusing our thoughts and actions on the city we might bring together these hitherto disparate elements of human society and see them within a much more coherent vision than any other social paradigm could provide.

Arcosanti is intended to be an *urban laboratory* for the purpose of investigating the process of designing building and operating a functioning prototype arcology which will explore the ways in which the city infrastructure might contract and intensify in order to become more efficient, ecological, and sustainable. On the basis that there can be no learning without experimentation, the laboratory is the place where, through the trials and errors of lived experience, the basic tenets of the arcology theory are being tested. Although Arcosanti is not an experiment itself it is a framework, or container for different experiments, a place where ideas and processes can be conceived and tested to destruction in order to understand them better. Failure is recognised and acknowledged as an integral part of the life of such a place, simply part of the learning process (see Plates 34 & 35).

As an urban laboratory, Arcosanti is involved in research within the Complexity-Miniaturization-Duration paradigm and within the field of environment and habitat. The premise of the research work is that, since the urban phenomenon is seen as a process of increasing complexity, one which must take place in proportionally shrinking spaces then "a miniaturization of its structure become s indispensable".[26] The project aims to become a catalyst for the focused search for urban alternatives that are currently ignored or dismissed. More specifically it aims at constructing a living demonstration of a compact three-dimensional town as a proposed alternative to suburban sprawl. Soleri wrote of the priorities of Arcosanti in 1969:

> The subject is the city. The aim is:
> - A historically sound concept of the morphology of the city as an evolving organism.

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[26] Soleri, *Arcology* (1969), p. 121

- A testing of the conception by a verification process, transferring ideas into the actual construction of a micro-city.
- To proceed from beginning to end of the program, already under way, in the manner of an open-ended process to be lived in and experienced by some thousands of apprentices and students.

The collective work constitutes ideas and a processes, conceived within the *urban effect* frame of reference which:

- do not reject the existing technologies of energy production but try to define a more responsible and less intensive use of the resources that they make available;
- do not seek energy self-sufficiency since, Soleri believes this to be impossible practically and ontological nonsense;
- reject the two-dimensional planning grid of existing communities as wasteful in both human and natural resources and instead demand the exclusion of the car from the habitat and the reinstatement of the pedestrian;
- advocate greater integration and proximity of the diverse activities of people;
- seek to bring the urban landscape into the presence and action of the Sun according to its seasonal character;
- advocate the self-containment of the urban habitat for the sake of frugality; instantaneous access to open land; the reciprocity of the city and the countryside; the pedestrian or bicycle mode of the community; the desegregation of social, cultural, economic, and productive context of the community; countering the empty street syndrome and the danger of alienation; vandalism, violence and crime that it encourages.

Since it is largely self-financed, primarily through the sale of bronze and ceramic wind-bells, the project has, of necessity to be a "simplified, ambiguous, tentative, assessment of the urban phenomenon" as well as a modest attempt to contribute to it. Soleri argues that these characteristics constitute, in any case, the fundamental qualities of reality.[27] He believes that simplicity (limitation), ambiguity (dialectic), and tentativeness (probing), legitimise Arcosanti as a laboratory while, at the same time, offering guidance as to where the emphasis of the research should be: on energy and resource efficiency, food production, desegregation of living, working and learning, social-cultural intensity, self-reliance, a degree of autonomy, and the search for identity.

9.5.1 Ongoing programmes

There are a number of projects ongoing at Arcosanti which involve the community in a wide variety of activities ranging from project development, networking and media work,

research activity, exhibitions, drafting work, conference organisation to wind-bell production and site maintenance. These including *Construction Workshops; Arcosanti Organics; Energy Apron* and *Greenhouse Experiments; Minds for History; Paradox; Arcosanti 2000*; and *Arcosanti Super Critical Mass.* These are briefly outlined below.

9.5.2 Construction workshops

The seminar and construction workshops at Arcosanti have been ongoing since the project began and are based on the Siltpile Workshops held at Cosanti from 1962, initially for architecture students from Arizona State University.[28] In 1970, the Cosanti Foundation shifted the summer workshop program to the new Arcosanti site. The workshops today are designed to be a "learning by doing" experience in which participants are involved over a five to six week period with learning ways to approach a variety of tasks and problems, within the aegis of the *urban effect* - from lifestyle choices to urban design. There is an initial one-week intensive course introducing the Arcosanti project and discussing aspects of the arcology theory, largely as contained within the 63 topics outlined in *Arcosanti: An Urban Laboratory?* (1984). During this 'seminar week' participants attend lectures documenting development and construction history; take site tours and nature walks; discuss architectural plans and models of the project; produce silt-cast sculptures; and sample some of the ongoing construction work. From the remainder of their stay they take a hands-on approach and are actively involved with work on some aspect of the project on a regular daily basis. This could involve, for example, the continuing construction of the *East Crescent* complex, recycling duties (all paper, metal, plastic, and glass waste at Arcosanti is separated and removed for recycling), site maintenance, and cultural events preparation. The work assignments are made according to the project's needs and, as much as is possible, on the basis of interests and skill levels of the participants (see Plate 36).

The Siltpile Workshop was re-introduced at Arcosanti in 1984 and is now available to offer participates the opportunity to learn the silt and earth-casting techniques used to produce the wind-bells, bridge models and buildings at Cosanti and Arcosanti.

Workshop participants mostly sleep in individual 8ft by 8ft by 8ft pre-cast concrete cubes in the 'camp' at the eastern edge of the site, down by the Agua Fria River. The overall character of the 'camp' is that of a small farm village with the cluster of cubes, enclosed within trees and hedge growth set amongst gardens and crop fields. A few outbuildings include the experimental

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[27] Soleri, *Technology and Cosmogenesis* (1981), pp. 102-3

greenhouse and the "octagon", a community structure, complete with a wood-burning stove in the centre, a piano, and metres of bookshelves lining the walls.

Completion of the Arcosanti workshop entitles individuals to be considered for residency and volunteer work. Employment depends on the individual's performance and the availability of a staff position. All the residents are expected to share in site maintenance. Generally those who want to stay, and are seen to be of value to the community, become part of it. As in any close knit community strangers are treated with caution. It is the same at Arcosanti. There is a 'rites of passage' involved. Individuals gain acceptance by the actions of their lives and by the stories they tell. Then they tend to migrate to one of the shared habitats on the hill. The accommodation there is a little less basic, and in winter, it's a lot warmer. The notion of the shared habitats, such as *East* and *West Housing,* is of the 'cubes' clustered around a communal living space with a wood burning fire. Adjacent to this space are cooking and washing facilities. It is in these shared spaces, at the end of the working day, that people gather.

Those who have chose residency at Arcosanti adopt a lifestyle, which to many in consumerist society is unthinkable. There are sacrifices; no school, no library, no hospital, no cinema or shop. The place is too small to sustain these. But people stay. Being part of a community is part of the reward.

9.5.3 The Arcosanti internship programme

During recent years Arcosanti has offered an extended stay option in the form of an internship program. This program gives those with relevant experience, and who are able to give a three-month commitment, the chance to work within specific areas of the project:

- archives;
- agriculture;
- bronze foundry;
- ceramics studio;
- construction;
- landscaping;
- planning/drafting;
- woodworking.

The *archive internship program,* for example, now offers participants an opportunity to explore Arcosanti's development history, study Soleri's work and accomplishments over the last 50 years, while helping to preserve a part of architectural history. Administrative tasks involve

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[28] Six earth-cast concrete structures were built at Cosanti by the summer Siltpile Workshop students between 1964 and 1974. Today these structures comprise the Cosanti complex, and are used as craft studios, work areas, offices and residences.

cataloguing, labelling and filing sketches, drawings and models as well as written material, and maintaining a database of archive materials. The work also intermittently involves providing archival research and reproduction assistance and producing supporting materials for print and electronic media and publication, websites, events, exhibitions and special programs.

9.5.4 Arcosanti organics and greenhouse experimentation

Arcosanti Organics is the agricultural program at Arcosanti. It maintains two greenhouses, two gardens, a field, peach orchard, and a small vineyard (see Plates 37 & 38). The agricultural programme embodies Arcosanti's belief in stewardship while addressing a perceived responsibility to revive interest in growing food organically and provide the Arcosanti project with fresh produce. It is intended that an agricultural content is incorporated within future workshop programs, where participants interested in gardening could work towards improving the existing systems.

The two greenhouses are part of a sustainable food production system. Although the production levels currently fall far short of the consumption demands the aim is towards a greater degree of future self-reliance at a basic level of nutritional provision. The large greenhouse faces due south and has a recessed concrete base. The 150 square metre area contains four terraced growing levels over rock bed storage and heats and ventilates an attached 12metres by 3 metres residence and office. The rock bed acts as thermal storage set within concrete beds. In combination with a simple system of manually operating vents it helps regulate the temperature within the greenhouse via the *heat-sink* and *greenhouse effects*. During the summer the vents are kept open continuously and shade cloths are stretched over the experimental greenhouse to protect the plants from the scorching summer heat. A mister system also lowers the temperature. The structure also includes a potting room, a seed and tool storage room, and a dehydrating loft. The smaller greenhouse is connected to the camp's shared bathroom.

9.5.5 The energy apron

In the *Two Suns Project* Soleri had discussed the theoretical potential of the urban scale of the *greenhouse effect*. At Arcosanti he has been working towards a large-scale practical demonstration of this idea. The area covered by the greenhouses is described as the *energy apron*. Locating the greenhouses lower than the habitat structures and spaces means that the naturally accumulating warm air can be passed through tunnels up into the living areas. Because of convection no additional energy is required as long as there is a chimney at the end of the

tunnel. Cooling using evaporation is also being explored, whereby cool air created by misting at cooling towers at the top of the structure, forms moist air which falls back through the tunnels. With his design staff and external consultants he has undertaken greenhouse research and design development since 1974. The conceptual work involving the design of a large central system for food and energy production was carried out from 1974-1976.[29] Extensive research, carried out from 1976-1978, resulted in the construction of a prototype greenhouse in 1979. This facility has been operating in a passive mode since March 1979, generating both agricultural and climactic data necessary for further greenhouse development, specifically aiding in the designs of the first full-scale segment of the *energy apron*. Soleri wrote about the Arcosanti greenhouse research project in 1985:

> If the greenhouse is on a flat area, quite definitely you need energy and equipment to ventilate the greenhouse in the summer, but if you slope the greenhouse, you introduce the chimney effect, and the greenhouse is self-ventilating. One can take the greenhouse and make it into a wafer, a sun collector, then you can incorporate the sun collector in the roof. This is the normal way of going about producing hot water. Or you can make the greenhouse with two effects: one as a sun collector, and the other as a food producer. Warm air can be pumped into the house and can produce some vegetables, as a form of energy, which is, let's say, the warm air, automatically through the chimney effect. If one takes the house and transforms it into a multiple kind of aggregate like a village or a town, and then one enlarges the greenhouse proportionately, one begins to see the possibilities of having a solar town.[30]

The greenhouses are designed to benefit from:

- *heat collection* - curved surface retaining walls are designed to collect maximum winter sun and create a warmer environment in the greenhouse;
- the *greenhouse shading* - deciduous plants growing from the membrane support columns will shade the greenhouse during the hot summer months. Winter leaf drop will allow maximum sun penetration;
- a *membrane system* - the greenhouses will be covered with a polythene film anchored on four sides and tensioned by jacks to eliminate tearing of the membrane by wind flutter. The film will be used instead of glass for both economic and aesthetic reasons.

In addition to the practical aspects Soleri observes that the greenhouses will be "a demonstration of ways to touch on global issues: food inequity, climate change, and how to produce food in an ecologically sane way".[31] Most of the world's arable land is already under cultivation. The remainder is deemed largely unsuitable, being too cold, wet, arid or

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[29] This work was made possible by a grant from Xerox Corporation, with matching funds from the Cosanti Foundation, the American Revolution Bicentennial Administration and the Environmental Research Laboratory at the University of Arizona.
[30] Soleri, *Technology and Cosmogenesis* (1985), pp. 138-9
[31] P. Soleri, *Double Exedra: the Indian School Proposal* (Unpublished Cosanti Foundation Paper, 1991), p. 12

mountainous to sustain current agricultural methods. Increasing global food production by improving the productivity of land already under cultivation is one method of obtaining higher yields. Another is to explore methods of bringing marginal lands, generally ill-suited to agriculture due to adverse climatic and topographical conditions, into production. Arcosanti's experimental work on the passive *energy apron* addresses both of these areas of investigation. The experimental greenhouses aim at gathering conclusive data as evidence of the benefits of their wider application as part of an integrated urban design strategy.

Arcosanti is located in the semi-arid desert highlands of Arizona. Similar climatic conditions are common to around two-thirds of the world's marginal. In such an arid climate the greenhouse allows frugal water management by using only a tenth to one thirtieth of the amount needed for open-filed irrigation. Within the desert environment, which has a high percentage of sunny days throughout the year, this is clearly a significant factor. Because of Arcosanti's altitude cold winters are problematic to crop growth but, within the greenhouses the growing season can be extended all year round, doubling the yield. During the winter, crops in the greenhouse grow much faster and without the stress of frost. A larger variety of food can also be grown which can supply the cafe and residents with salad greens which grow quickly and remain tender because of protection from temperature extremes and winds. The greenhouses also contain flowers, herbs, and tomatoes year round and keep a variety of crops planted successively for continuous harvest.

Successful food production methods, thoroughly researched and tested, in a living/working environment such a s Arcosanti could prove to have a much wider application. In 1990 the *energy apron* project received funding of $100,000 towards the estimated construction cost of $540,000.

9.5.6 The minds for history institute

The *Minds for History Institute* was established at Arcosanti in order to generate and develop a comprehensive program for "salvaging, probing, revealing and documenting" the thinking processes of some of the most influential thinkers of our age. This enduring process of "recording minds for history" began with the first *Minds for History Conference,* which was held at Arcosanti in 1988, and has carried on since. The aim has been reach deep into the stock of knowledge that society generally stores away in fragmented forms within a variety of subject areas, but focusing less on the disciplines as such, and more on the "living generators" of the thinking process - the 'minds' that 'make history'.

The institute is structured along the following lines[32]:

- *minds directory* - this is the first document to be produced and contains a concise statement of each participant's (mind's) thesis. This is submitted to the other participants in advance of the conference and becomes the basis of the discourse. The directory, containing 20-40 statements per volume is made publicly available before the conference.
- *theatre of the mind* - eight participants share a stage for 2-3 days of in depth discussion which develops from their prior statements. An audience of around 300 observers from academic, corporate, religious, environmental institutions are allocated time to join in the dialogue. A 'moderator' and a 'jester' complete the theatrical format.
- *minds biographies* - this second document consists of one volume (and a videotape) for each participant. The contents are an organised and edited account of the "probing of the mind" preceded by the original thesis. Each biography is therefore 'co-authored' by those engaged in the dialogue, including the best of the interactions with the observers.
- *mind-brain-artificial intelligence convergence* - when a large number of biographies have been developed Soleri predicts a need for an evaluation of the knowledge generated and its significance in history. Part of the institute's mandate is to facilitate the emergence of an "artificial intelligence" which, Soleri suggest, might eventually find convergence within the comlexity-miniaturization paradigm. In this way, he argues, "the interdependence of *Minds for History* and micro-technology will emerge clean and strong".
- *minds encyclopaedia* - the third document is constructed around the sciences and current technologies dealing with the brain, intellect, mind, time, space, and memory. The encyclopaedia aims at the integration of the individual human mind with a wider conception of the notion of mind (including what Soleri calls "the mind-fullness of reality").

Past participants, as well as Soleri's suggestions for future 'minds' within a variety of subject areas include[33]:

- *moderator* - Walter Cronkite, Phil Donahue and David Frost;
- *jester* - Bill Cosby, Lily Tomlin and Alan Alda;
- *aesthetics/arts* - Federico Fellini, Sam Sheppard, and Philip Johnson;
- *economics/business* - Kenneth Boulding, Maurice Strong and Kirkpatrick Sale;
- *health* - Benjamin Spock, Christian Barnard and Martina Navratilova;
- *futurism* - Isaac Asimov, Paul Ehrlich and Jane Jacobs;
- *law and social order* - Betty Friedan, James Farmer and Mel Roman;

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[32] P. Soleri , 'Minds for History: An Arcosanti Institute' (Cosanti Foundation, Arcosanti, 1988)
[33] *Ibid*

- *literature*- Maya Angelou, Alan Ginsberg and David Mamet;
- *media management* - Rupert Murdoch, Alistair Cooke and Michael Korda;
- *performing arts* - Jane Fonda, Placido Domingo and Chou Wen-Chung;
- *history/biography* - Bruno Zevi, Lewis Mumford and Vincent Scully Jr.;
- *philosophy* - Doris Lessing, Susan Sontag and Elie Wiesel;
- *politics* - Jessie Jackson, Jerry Brown and Mario Cuomo;
- *inorganic sciences* - Fred Hoyle, Fritjof Capra and Freeman Dyson;
- *organic sciences* - James Watson, James Lovelock and Lynn Margulis;
- *technology* - Lee Iacocco, James Burke and John Allen;
- *theology* - John Cobb Jr., Raimundo Panikkar and Harvey Cox.

9.6 Arcosanti 2000

Arcosanti 2000 is the most current design proposals for the completed project. The design dates from 1990 and involved proposals for a cluster of structures planned along the Agua Fria Canyon Rim directly north of the existing site (see Plate 21). The structures were structured separately to allow for a phased development, although for ease of access all the buildings are connected. The energy efficiency is to be achieved through:

- southeast exposure;
- cool air misting;
- solar access due to the tall central structure;
- possible photovoltaics.

The main purpose of the proposal is as a learning and cultural centre with a permanent population base in the region of 30-50 percent. The construction cost at the time was estimated at $500 million.[34]

9.6.1 Super critical mass

More recently, Soleri has defined a step on the way to the larger scheme in, what he terms *Super Critical Mass* (1995) in which a smaller community of 1,500 people are to be accommodated within three double exedra that embrace and partly enclose the existing south facing structures on the site (see Plate 40). Although much smaller than those structures proposed for *Arcosanti 2000,* the Super Critical Mass phase of the project includes all the physical effects of the *Two Suns* approach that would promote the notion of the "energy city", as well as the social and philosophical concepts envisioned within the arcology theory. Among the

buildings planned for this phase are the *Greenhouses*; the *Exedra* enclosing residences and office, retail and commercial space, adopting a *green mantle* and exploiting *garment architecture*; a conference centre named in homage to the main sources of Soleri's philosophical heritage the *Teilhard de Chardin Cloister;* the *West Crescent complex* for 200 guests; and a market area with a covered pavilion and amphitheatre;

In the *Super Critical Mass* stage the greenhouses provide residents with a basic supply of fresh vegetables and fruit. Together with the produce from the lower valley farming lands this offers the basis of an essential diet. The greenhouses extend the growing season at Arcosanti from 6 months to a full year. By locating them on the sloped side of the mesa a number of different micro-climates are created which allow the possibility of a wider variety of crop production. Part of the greenhouse roof is used as surface area for solar collectors to generate electricity and water heating.

9.6.2 Double exedra

The three main *double exedra* are concentric, open to the south and define an internal curved area as the 'main mall' and public space. These three curved spaces interconnect and have a variety of functions: as gardens, walkways, meeting areas, open market places, areas for cultural activities, or special community events and gatherings. At the ground level there is a combination of retail and commercial units, and small business workshops. The inner exedra are only partially residential at the upper levels.

The outer exedra contain most of the residential accommodation with a typical apartment totalling 200 square metres with a floor to ceiling height of about 7 metres. Residents can adapt this space according to their individual needs, either by retaining the height or adding another floor level. The additional spaces may be used as residential, offices, commercial space or a combination of these. As is the case throughout Arcosanti circulation is fully pedestrianised. The main east-west axis of the town is to the front of the double exedra but the outer exedra are also connected by a 'street' at upper levels. Vertical movement is through elevators on the northern side of the outer exedra (see Plates 39 & 40).

9.6.3 Green mantle

The exedra offer residents both the intensity of activities on its inner (south facing) side as well as the view and privacy of the outer side (north facing) with its views over the desert. On this north side, fruit trees are planted on each garden terrace, scaling down to form a *green*

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[34] Arcosanti Residents, 'Arcosanti Alumni Bulletin' (Cosanti Foundation, Arcosanti, October 1990)

mantle. The trees, which provide food, are irrigated by an automated system that releases mist over them creating a 'heat filter' (see Plate 39). The hot, dry air passes through this moist quilt of green canopies which traps the heat within their foliage. The air that arrives inside is 20-30° F cooler than the outside temperature.[35] Another advantage of the green mantle is that, as part of the daily watering routine, a down-draft cascade of air cooled by atomised water will diffuse onto the lower terraces and the public malls.

9.6.4 Garment architecture

Attached to tensile cables stretched between the inner and outer exedra transparent or opaque membranes can be opened or closed depending on the environmental conditions required within the public spaces. Similar to the system proposed for the *Hyper Building* the *garment architecture* utilises the *greenhouse effect* (through transparent membranes that draw warmth into the structure during cold evenings and in winter) which can then be channelled through the residences via warm air convection using chimneys located on the northern side of the external exedra. Shade can also be provided from the Sun by using opaque membranes during the hot summer months (see Plate 39).

Soleri believes that the exedra form has great potential in terms of energy efficiency and in coordinating the various physical effects previously developed within second generation arcologies:

> The synergistic combination and the locality of activities... in the Double Exedra, the climate transformations via the Apse effect and others - the Energy Apron (warming up), the "green mantle" (cooling down) - will generate an intense social-cultural milieu sustained by the market and economic enterprises of the town.[36]

9.6.5 Teilhard de Chardin Cloiste/Complex

This is designed as a nondenominational religious centre to be used for ceremonial activities of different faiths as well as a centre for research and education in theological studies (see Plate 42). This complex will house a minimum number of dwelling units ("cells") for the residence of scholars pursuing a more monastic lifestyle. Foundations were laid for the *Teilhard de Chardin Cloister* in 1975. The site is currently used as a Siltcast Studio for workshops hosting a variety of courses on the techniques of earth-forming cement. A pergola structure also acts as mounting for evening slide show projections on the rock wall of the opposite mesa.

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[35] Soleri, *Double Exedra* (1991), p. 12
[36] *Ibid*

9.6.6 West Crescent complex

Due to the experimental nature of the urban laboratory and the shifting nature of the population at Arcosanti, a hotel facility is included within the West Crescent complex. This contains individual rooms on the first two floors and a youth hostel on the upper level.

9.6.7 Market

Light canopy structures create the marketplace open to both Arcosanti residents and the neighbouring communities. In addition to augmenting the economy of Arcosanti, Soleri hopes that weekly markets will encourage social and cultural interaction between the communities and will strengthen Arcosanti's role in the Cordes Lakes region. The market area, along with the pavilion and amphitheatre will be used as the venue for celebrations and annual events.

9.7 The paradox project

Paolo Soleri proposed the *Arcosanti Paradox Project* in early 1997 (see Plate 41):

> Since Arcosanti is a place in search of the miniaturized by way of complexity, and since cyberspace is a non-place in search of the complex by way of miniaturization, I am proposing an internship which will bring these two places together via the practice of building and living in a non-virtual environment frugally imprinted, a habitat dedicated to urbanization.[37]

The project has two main aims:

1. To explore the fundamental issues raised in the intersection of arcology (the miniaturisation - complexity - duration paradigm) and Internet (the World Wide Web).
2. To support new funding initiatives for Arcosanti targeted at members of the cyberspace community.

Soleri believes that the global expansion of the Internet during the 1990s has created a new subculture of relatively young and affluent "cybrarians".[38] He argues that these cybrarians represent a fundamentally new potential source of support and funding for Arcosanti.
There are already hundreds of millions of people using the Internet, and the uptake, is expected to continue to grow exponentially over the next few years.

To realise its potential it was recognised that the Arcosanti community must interact with this fundamentally new community in the virtual place where cybrarians meet and learn - in cyberspace itself - by using the means and language that its members respond to. The most

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[37] P. Soleri, 'The Paradox Project: Draft Proposal' (Cosanti Foundation, Arcosanti, January 1997)
[38] N. Negroponte's term for Internet users

effective means of promoting such new initiatives is via the World Wide Web, using a combination of web sites, virtual online communities, real-time chats, and email. The five main initiatives of the *Paradox Project* are the *Arcosanti Website*; the *Paradox Virtual Community (PVC);* the *Virtual Arcosanti Model (VAM);* the *Paradox Workshop;* and the *Paradox Conference* series:[39]

- Arcosanti already has a high-quality web site, which continues to evolve under the current direction of Rob David, Arcosanti's Webmaster. The site can be accessed at http:www.arcosanti.org/html.
- The *Paradox Virtual Community* (PVC), is in the process of being designed and implemented as an asynchronous virtual community, which includes real-time chats, and email capabilities. The Arcosanti web site and the PVC have complementary roles, with the web-site providing multimedia information about Arcosanti, and the PVC providing a two-way interactive communication and project planning/co-ordination capability for those interested in Arcosanti and Paradox.
- The *Virtual Arcosanti Model* (VAM), now underway, is the third element of the Paradox Project. Its purpose is to provide a virtual experience of living in the completed *Arcosanti 2000* arcology. Using VRML (Virtual Reality Modelling Language), users can take a self-paced walk-through parts of the *Arcosanti 2000* model.
- The *Paradox Workshop* has recently been successfully tested, and will run concurrently with the standard Arcosanti Workshop Program. Participants, with prior computer skills, spend half of their workshop time working on the *Paradox Project.* Those who are willing to make a minimum 2-month additional commitment to implementing a particular element of the project may be selected to stay on at Arcosanti as "Paradox Associates". The intention is to gradually assemble a team of skilled cybrarians at Arcosanti to fully implement the *Paradox Project.* Being able to spend part of the day working physically and part of it working virtually in a place such as Arcosanti is attractive to many, but some will find it difficult to disengage themselves from their own professional life long enough to do this, especially if it means taking time away their area of expertise. In the world of IT things move very quickly and it is not difficult to fall behind and have to scramble to catch up. A current proposal is that the Teilhard de Chardin Cloister becomes the physical centre for the Paradox Project at Arcosanti. It will take a long time to build the cloister, so whatever benefits are to be gained once it is built, they will not be available to the people who build it. Marcos Novak argues that more detail is needed to make this a workable proposal. For example, how will this

[39] P. Soleri, 'The Paradox Project' (1997)

place be equipped? Is the proposal itself sustainable? High technology fast becomes obsolete so the problem will be "how to maintain an insane, fast, high external pressure, high-capital facility within a sane, slow, high internal discipline, low capital complex".[40] Unless this is answered, he believes that few people will join the effort and many will be disappointed by the inevitable inability of the reality to live up to the promise of the vision.

- The fifth element of the *Paradox Project* is the annual *Paradox Conference*, held each autumn at Arcosanti. The first such conference took place in October of 1997and was attended by around 150 cybrarians, many of whom are now involved in various aspects of the *Paradox Project*. The second Paradox Conference, dubbed "Paradox II: Cyberspace Embodied," co-sponsored by several departments at Arizona State University, took place in September 1999 and had over 300 participants. It was billed as an inquiry into the integration of cyberspace, virtual reality, and habitat, in the context of Teilhard de Chardin's hypothesis on the formation of the noosphere as a critical stage in human evolution. Panelists included a cross-section of high-level cybrarians who are professionally involved in creating cyberspace, virtual reality, and artificial intelligence technologies. Informed critics of the potential "dark side" of cyberspace and artificial intelligence (AI) also attended.

Teilhard de Chardin's notion of the *noosphere* [1.1] has influenced many innovators of cyberspace technologies (for example Paradox II panellists Marcos Novak [RealityLab]; Mark Pesce [VRML co-inventor]; Erik Davis [author of *TechGnosis* (1999)]; Michael O'Rourke [Dimension 7]; Nathan Vogel [MindsEyeMedia]; and Stephen Perrella [Hypersurface Systems]). They also claim to have been influenced by Paolo Soleri's ideas and the work at Arcosanti.
Over two days numerous speeches, seminars and debates were held on such topics as quantum mechanics and the future of digital television; the role of 'Alpha' or 'Omega God'; the Internet as the future of mind, the biological and physical identity of consciousness at the beginning of the twenty-first century. Many questions were posed during the conference such as: If space is made intelligent through ubiquitous computation, communications, pervasive embedded sensors, the global positioning system, augmented reality, and so on, how should we build? If there are cities in cyberspace how would Arcosanti relate to them? Where does Arcosanti go from here? And more importantly, what - and who - becomes Arcosanti from this point on? After his visit to Arcosanti, Mark Pesce wrote:

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[40] The Paradox Project (Homepage, 2000) <http://www.arcosanti.org/paradox/panel.html#paolo>

Coming back to Phoenix after three days in Arcosanti I saw in full the idiocy of it all. All of the endless, wasteful sprawl, around making some mythical quality of life possible, which they inevitably lose in inevitable travel from home/school/office/shop/life. Paolo's ideas have been very influential, perhaps far more so as ideas than as implementation.[41]

Marcos Novak suggests that:

> [Soleri's] ideas need to be disseminated more widely and more dynamically. The present site is very useful, but it is still rather touristic. Browsing through Paolo's books, I was struck as much by his diagrams as by his written ideas and the designs of his arcologies. The diagrams respresent a living system - something that should be presented as an active simulation with real-time inputs.[42]

He advocates the construction of computer simulation models, "one for the American Dream as it is and one for Paolo's alternative", allowing the sustainability of each to be examined on a real time basis. He believes that Soleri's ideas about the physical city are as pertinent as ever but that there is a much larger intellectual and philosophical ambition at work. In addition to the physical arcologies, he argues that Soleri's concepts must be applied within virtual arcologies and digital communities as part of the virtual world now being constructed:

> I am not speaking of making walkthroughs of potential physical arcologies, though this too is necessary, I am proposing that the principles that guide the design of the physical be brought to bear on the design of the virtual. At present we are bringing the worst of the physical into cyberspace. Nothing describes cyberspace as is it developing better than the notion of the 'strip-mall' - and endless proliferation of small and not-so-small commercial interests with no larger goal in mind than the hijacking of attention through loudness. There is an assumption that, because it is spatially unlimited, cyberspace must sprawl forever outward. This assumption can be questioned by the disciplines of miniaturization, complexification, duration: a better cyberspace can be produced if we realize that we need the urban effect in virtual as much as in physical space. Paolo's *Space for Peace* proposal may be the perfect place to start. I am proposing that Paolo and the Arcosanti community write a new chapter to the ongoing story of arcological thinking.[43]

Other participants, such as David Traub, were surprised that "in violation of his own rather strict almost eco-fundamentalist, hands-in-the-earth ideology, Paolo Soleri let this conference happen at all". The greatest paradox was seen as the *Paradox Project* itself:

> The old versus the new; those set in their ways, versus those seeking the way; the pouring of concrete versus the running of code; the debate for building versus the debate for meaning; the search for a cogent and utopian business model versus the fact that all around us was Paolo's - his land, his buildings, his heritage, his legacy.[44]

But Erik Davis, author of *TechGnosis* (1999), perhaps best articulates the overarching spirit amongst the majority of attendees at the conference:

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[41] *Ibid*
[42] *Ibid*
[43] *Ibid*
[44] *Ibid*

> A turning is in the air. Slowly, tentatively, a 'network path' arises from the midst of yearning and confusion, a multifaceted but integral mode of spirit that might humanely and sensibly navigate the technological house of mirrors without losing the resonance of ancient ways or the ability to slice through the greed, hate, and delusion that human life courts. [45]

The fact that the *Paradox Project* is yet another initiative to emerge from Arcosanti says a great deal about the project's ongoing commitment to the future and as much about the energy and creativity of those who continue to work there. Funding the construction costs of Arcosanti has been an ongoing struggle since its inception in 1970. Since then the philanthropic support has fallen far short of the amount required to significantly increase the pace of construction. This situation has continued, in spite of several major funding initiatives supported by professional quality business proposals. It is hoped that the emergent property from these cyberspace initiatives will be an ongoing interactive participation in the *Paradox Project* by a growing number of cybrarians. Such ongoing collaboration between Arcosanti and the cyberspace community may provide the necessary impetus for the sort of outreach, involvement, and growing personal commitment that can lead to the levels of support and realisation of funding potential that might see Arcosanti move, more quickly, toward completion. Novak is upbeat about the potential of the *Paradox Project* to accelerate Arcosanti's progress:

> Arcosanti must contend with the issue of non-locality in any case, why not begin here? Do this first, so as to expand your visibility worldwide. Register what is relevant to the present and near future and address it with lucidity, vision and courage. Become relevant to the information age in a way that millions can understand. Do this well and you will not be lacking for people to do either the physical or the virtual work - or both.[46]

Soleri would love the new affluent Internet millionaires to support the completion of Arcosanti but for him the *Paradox Project* has even wider significance. His message to the entrepreneurs at the conference was simple - Don't put all your passion and creativity into cyberspace if it means turning your back on the real world, where your body must live in the coming millennium. At *Paradox II* he promoted the idea "that we need a lean alternative." He took the opportunity to sow the seeds of a more evolved world, based on community, creativity, frugality. He argued that 'lean' does not mean deprivation: "we would be more alert, more lively, more aware and more equitable". In cyberspace, he said, "people tend to communicate through the machine...not as a person. The Internet is almost a magic kind of thing now. Only when we can get past the 'magical perception' of technology can we make sense of it".

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[45] E. Davis, *TechGnosis: Myth, Magic & Mysticism in the Age of Information* (1999)
[46] The Paradox Project (Homepage, 2000)

> *Paradox* in its moments of intensity seemed to me to be probing and groping for universal animation. That is why I am so grateful to all those hyper-wired minds on the podium and all the minds of the group assembled for the occasion. We must ground our exultation on the immense travail that has made the pride of being here and now possible and, sooner or later, we must seek the storm of equity and beauty that might eventually emerge in that singularity I call the *Omega Seed*. To nudge reality toward self-revelation is to be on the road we must construct and follow. To devise the steps that will bring about *Paradox* is now one of our tasks, while we try to make a coherent ensemble of that which is still only a promising and energetic cacophony.[47]

Paolo Soleri has long advocated the need to redefine the American Dream before it spreads too far across the overpopulated developing world. His own version of the dream attempts to reconcile individuals and community needs, and economic realities and motives; with ecological awareness and cultural achievement, and aims to bring us back from the brink of an impending and insane attack on our Earth's ability to sustain us. The project is now represented at the EXPO 2000 in Hannover, Germany. The theme of the Expo is "Humankind-Nature-Technology: A new world arising." Along with Curitiba, in Brazil , Arcosanti has been chosen to be one of the featured 'Projects around the World'.

Soleri has, through the years, been variously described as either a madman, a practitioner of some obscure religious order, or a visionary.[48] His writing is cryptic, his style complex and philosophical. In 1991, in describing the *Edge City* Joel Garreau identifies a common problem in the interpretation of his ideas:

> Soleri is still out there in the desert in Arizona building Arcosanti...But he keeps talking about eschatology and nobody can understand...a thing he says, so he has had little practical influence in current urban planning.[49]

There is some evidence that this is now changing and that, while we may not understand or agree with everything he says, more people, particularly those involved in shaping the built environment, are moving some way, towards his way of thinking. Today there is renewed interest in ecology and people from around the world continue to be inspired by arcology.

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[47] P. Soleri, 'The Paradox Project' (1997)

[48] See, for example, P. Plagens, 'A Visit to Soleri's Eldorado' in *Art in America* 67 (1979), pp. 65-71; J. C. Glen, 'Prototype Communities of Tomorrow: Arcosanti' in *The Futurist* 14 (1980), pp. 35-43; J. T. McFadyen, 'The Abbot of Arcosanti' in *Horizon* 23 (1980), pp, 54-61, ; M. B. Pennington, 'Arcosanti Monastery No, 1' in *America* 144 (March 14, 1981), pp. 207-9; N. M. Bloom, 'Human Beehives: Paolo Soleri's Arcosanti' in *Science Digest* (March 1981), pp. 42-7; M. Grossworth, 'Arcosanti: A Laboratory for the Living' in *SciQuest* 54 (1981), p. 11-15; D. W. Dunlap, 'Future Metropolis' in *Omni* 7 (October 1984), pp. 116-24 P. Weingarten, 'Futuristic City: a Radical Vision Still Out of Focus' in *Chicago Tribune* (July 10, 1988); L. David, 'Paolo Soleri : Man for All Seasons' in *Ad Astra* 1 (November 1990), p. 31; 'Paolo Soleri's Arcology: Updating the Prognosis' in *Progressive Architecture* 72 (March 1991), pp. 76-8; M. Pastin, 'For Selfish Reasons, Arizonians Should Look Again to Arcosanti' in *Business Journal* (May 20, 1991)

Governments in China, India and Japan are seeking out Soleri's advice on urban development matters. Environmentalists have nominated him for a Nobel Peace prize. The world is increasingly becoming aware of ecological limits and the need for sustainability but it seems it does not yet have the understanding that would allow it to give the kind of support and encouragement that could long ago have seen the prototype arcology at Arcosanti completed.

> If the price that is put into an aeroplane was given to us, for some reason, then we would have an arcology. That's not possible so we are trying to do what we can with the means we have, and the know-how we have. This is very limited in many ways. We are not very professional in any direction but that's part of the pioneering - non-professionalism. So we are pioneering and...we'll see.[50]

Although Arcosanti is far from complete, Paolo Soleri trusts in the validity of his arcology model. Daily he perseveres, dreams, designs and slowly builds in the hope that one day the first arcology will be built. When construction work started at Arcosanti he believed it would be completed within ten years. At over 80 years old he now reluctantly accepts that he may not be around when "critical mass" is reached but he says he is proud that the community founded in the early 70s has survived this far. He stresses that, "survival is very critical. It's an indication that we're serious".[51]

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[49] Garreau, (1991), p. 249
[50] Soleri cited in Mayne, *Soleri's Cities: Architecture for the Planet Earth and Beyond* (1993)
[51] Soleri cited in Ostler, (1994), p. 12

Conclusions

Figure 10 The Hyper Building

Conclusions

> Architects have a duty beyond the daily round of consultation and individual projects to participate in the human debate, to bring their vision, their energy, their flair, their intuition to work for mankind. The profession does not deserve to survive unless it does. The planet will not survive if it doesn't.[1]

Theoretically, at least, the city is loved. It is where the majority of us live and where, across generations, our enlightened culture has polished the essential achievements of human civilisation. In such a tradition the city contains a society distinguished from the rest of nature. We can bear witness to the separation of, "territory from kinship, rationality from custom and myth, the civic compact of individuals from the archaic group cemented by the blood oath".[2] In a truly urban setting, ideally conceived, the city delivers the kind of social proximity, from which it promises to forge the self, identity and individual destiny. Within such an idealised arena compression may well produce radiance. This is where urban theory and utopian thought begin to merge together.

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[1] RIBA President Marco Goldschmied's inaugural address, Tuesday 5 October 1999

Marx said that urbanisation spoke, not so much about a city's dominance, as its lack of identity. Today the formless urbanity of megalopoly that sprawls out across endless landscapes of development, devouring energy and resources and destroying people and land in its wake, has also destroyed the ideal of the traditional city and turned the notion of city planning into a myth.

Through time architectural taste has varied in line with historical shifts in religious order and political regimes. But the art of building has been able to evolve, through stylistic changes, while maintaining its general individual identity within the built environment. The profound changes in our modern lives, born of the 'scientific revolution' initiated by Copernicus and the mechanistic conception of nature; reinforced in Cartesian dualism and the Baconian creed; fuelled by the Industrial Revolution and economic and cultural imperialism; and sent into hyperspace with the globalisation of capital and culture, have created a new social condition. The overlapping challenges of environmental decline, technological revolution and population explosion require us to look upon the built environment in new and different ways. But, as Mumford warned, our bricks of reconstruction will come to nothing, if we don't place solid foundations under them.

> Men are suddenly nomadic gatherers of knowledge, nomadic as never before, informed as never before, free from fragmentary specialism as never before – but also involved in the total social process as never before; since with electricity we extend our central nervous system globally, instantly interrelating every human experience.[3]

At the beginning of the twenty-first century we know a great deal about information. We can compress it digitally, pipe it into every home via satellite communications and terrestrial broadcasting, package it in forms that people understand; in words, pictures, diagrams, films, print and music. We have developed intimate systems like the telephone and videophone, the fax and the Internet, enabling people to exchange information rapidly around the world. We have invented machines that can record changing weather, land-usage and other global patterns from space; and with developments in digital media we are creating systems that will allow access to the accumulated information and stored wisdom of our entire history. A new knowledge based economy and information order is emerging from the proliferation and use of computer technology. This is changing the way many people work and how they spend their leisure time. A large proportion of the global economy is focused on the development of new cyberspace markets (the so called "dot.com economy"). Industries that that were previously discrete, such as those involved in computing, consumer electronics, telecommunications, and the broadcast and

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[2] Bookchin, (1980), p. 135
[3] McLuhan, *Understanding Media* (1964)

publishing media, find their interests converging – just as their means of production are converging in the binary code of digital information.

During the twentieth century technical inventions like electricity, telephones, cars, aeroplanes, radios, televisions, and more recently the personal computer and mobile telephone have profoundly altered how people live. There have been people in every generation, at least since the start of the Industrial Revolution who have believed that they were witnessing the most rapid changes ever seen in history. They have all been right. What distinguishes our own age is the rate of change and the time it has taken for new technologies to proliferate into the mass market .

Karl Benz built a three-wheeled car powered by a petrol engine in 1885 but it took until 1940 for cars to spread to 25 percent of the American population. The lag between the invention of the aeroplane (1903) and its mass-market proliferation was just as great (around 54 years). Household electricity was invented in 1873 but it was not until after the First World War that it spread to a quarter of the population. Cars, aeroplanes and electricity were all adopted slowly by consumers and therefore their impact on economic change was gradual. Even less expensive technology, like television and radio, took around a quarter of a century to spread to 25 percent of the population.[4] The computer and its invasion into the daily lives of Americans (and to a lesser extent the Japanese, Germans, and British) has been different and much more dramatic. The personal computer was invented in 1975.[5] It took just 15 years to reach a quarter of the U.S. population. Currently, lower prices of computers, combined with the fact that access to the expanding global Internet is free, is now further accelerating the pace of penetration of personal computers into the U.S. mass-market. It is hard to predict the consequences of this relatively new technology but it is clear that the world is changing. The Internet is now the largest computer network in the world with hundreds of millions of users.[6] The increasingly global use of the

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[4] Bunch and Hellemans, (1993)

[5] The 'personal computer' is a generic term for a single user computer based on a microprocessor with all the hardware and software required for a user to work autonomously. The term was coined by Alan Kay in the 1970s when the majority of computer users worked on mainframe terminals (terminals connected to large centralised multi-user systems)

[6] Internet inter-links an enormous number of local networks operated by universities, research centres, government departments, non-government organisations (NGOs), non-profit and commercial organisations worldwide. It origins lie in the *ARPAnet* experimental network created in the 1970s by the U.S. Government Department of Defence, in which various 'catastrophe-proof' networking options were developed. The result of the experiments was the Internet protocol – designed to let any computer communicate with any other computer, through different kinds of networks, so that in the event of partial failure in the network, data can be re-routed to reach its destination. The Internet, as we now know it was constructed in the 1980s to provide shared time on supercomputers for universities and research establishments and eventually grew to encompass the huge number of users 'online' today (an estimated 500 million)

Internet is leading to all types of changes for the world economy but in the less developed nations of the world there is a huge portion of the global population living in poverty. They are being excluded from the Information Revolution.

The embrace of information technology in general, and the attachment to the computer in particular, has fuelled a technological revolution in the workplace. Over the nineties companies have invested heavily in information processing equipment and computers and, as a result, have increased manufacturing productivity, boosted the economy and increased the global competitiveness of some industrialised nations. In the developing nations the use of computers, is limited. Although they contain around 80 percent of the world population and account for almost half of world GDP, these developing countries are home to a new 'cyber underclass'. With more than a billion people, China's share of world wide computers in use, for example, was 1.7 percent in 1997; with a slightly smaller population, India's share was even less.[7]

For the title of his book on the coming of the information economy and society, Barry Jones, the Australian academic/politician, borrowed a title from a Bach composition: *Sleepers, Wake!* He argues that the watchman on the heights is calling, but that his message could spell doom for all of us in the informational city, unless the sun also rises on the city of darkness just outside the gate. There is a riddle here, so far unanswerable by the wit of orthodox urban planners or social engineers and, as the new millennium dawns, it is casting a deep chill.

As cities around the planet reach unprecedented sizes, their increasing social and environmental problems need to be addressed if we are to avoid catastrophe. In his arcology theory Soleri has proposed a different way of urban life within a new form of city - one that he believes will prove to be more sustainable. Despite the obstacles, rejections and disappointments Soleri tenaciously holds to his philosophy. In attempting to define how society might change the arcology concept straddles both conventional values and reformist and radical methods associated with various shades of environmentalism. The realisation of a 'neonature' requires a radical transformation of the urban condition and yet Soleri, by endorsing the view that 'nature' exists apart from, (and largely for the benefit of) human societies is fundamentally human-centred in his outlook, upholds a fairly traditional (*conservative green*) approach to environmental issues. This is further reinforced by his support of the Romantic rebellion against the utilitarian, materialistic values of the "American Dream" and his advocacy of a more frugal alternative, within self-reliant communities modelled on natural ecosystems.

He shares with *mainstream greens* the rejection of the politics of both the left and the right, preferring to direct his aim 'straight ahead' via the agency of the urban system, while

emphasizing the importance of the individual and his or her need to revise values, lifestyles, and consumer habits. This idealistic tendency, a common characteristic in radical green thinking that can be traced through St. Francis of Assisi, Spinoza, Emerson, Thoreau, de Chardin, Leopold, Heidegger and Mumford, is interpreted in Soleri's urban philosophy as a form of *structural-functionalism*, in which societies are conceptualized as social systems (arcologies). The social structure (the *urban effect*), in turn, exhibits features that contribute to the maintenance of the system (the *apse, greenhouse, horticultural, chimney* and *heat-sink effects*). Arcology, in these terms, can be understood as an agency for the kind of collective action that recognises the need to review existing social-economic structures as part of an ongoing modernisation project which aims at, the transformation of the fundamental processes by which societies become developed, including industrialisation and urbanisation. Soleri also conforms to the mainstream green advocacy of a lifestyle of voluntary simplicity based on the idea of inherent scarcity and limits to growth.

Soleri also appears to share some of the radical ideas of the *anarchist greens*, believing that within an arcology people should organise themselves and have responsibility and power over their own lives. But although the individual is important he /she can only achieve fulfilment (*esthetogenesis*) in relation to the wider community (through the *urban effect*) . Decentralised economy and politics is the way forward in rural and urban co-operatives and communes (within arcologies).

Within the arcology theory there are similarities with the radical green position. Just as there are different positions associated with environmentalism, there are conflicting ideas in arcology. In the same way that we can identify a core of green values within ecologism [Table 5.2] it is possible to detect in various texts by Soleri since 1969, a number of the key ideas and beliefs within arcology relating to humans, nature, science and technology. Table 10 summarises these.

TABLE 10

ARCOLOGICAL VALUES COMPARED WITH GREEN VALUES

Arcological values	*Green value*
About nature	
1) Humans are part of nature but distinct from it. The distinction is important and should be reinforced.	Humans are part of nature.

[7] Quinlan and Stevens, (1998)

2)	Nature can and should be used for human benefit.	We must respect and protect nature for itself, regardless of its value to us, and live in harmony with it.
3)	We can and should also use science and and technology to aid human development but we must work within the laws of nature and the biosphere's limitations.	We must obey the laws of nature (e.g. the law of carrying capacity, which means that there is a limit to the number of people that the earth can support).
About humans		
1)	Humans can be co-operative.	Humans are naturally co-operative.
2)	Although currently human societies organise themselves hierarchically, true democracy and social equality will be achieved at some point in the distant future through the agency of the *urban effect.*	Social hierarchies are unnatural, undesirable, and avoidable
3)	You cannot measure our social standing by our material possessions. Society should progresses through *esthetogenesis* and be based on frugality, not on the continuous cycle of production and consumption and by inventing more complex technology.	Spiritual quality of life and loving relationships are more important than material possessions. We reject the latter, and live simply.
4)	Through a process of *complexity* and *miniaturisation* matter is being transformed into pure spirit. The ultimate aim of this process is to make "reality mindful" at a point of radiance called the *Omega Seed.* The function of arcology is to facilitate this process by giving meaning and direction to the human condition and putting the responsibility of transcendence collectively on human beings.	Logical, rational thought is more valid Emotions and intuitions are at least as important and valid as any other form of knowledge.
	In such a process facts and scientific evidence are only useful up to a point .	There is no such thing as 'objective' facts
About science and technology		
1)	Science and technology can solve many environmental problems, but it has to be a technology to come. The technology of transcendence is beyond our current imagination. Compared to biotechnology ours is almost beyond redemption.	Science and technology cannot be relied upon. We must find other ways to solve environmental problems.
2)	Progress in technology largely determines social and economic changes. It needs to be controlled.	We humans determine society and economics. Technology should be servant not master. Harmful technology should be banned.
3)	We need to guard against the simplification of reality by simple minded technology (like monoagriculture, oil refining, and atomic energy). Large scale 'high' technology is not, of itself a mark of progress.	Appropriate, and democratically owned technologies (e.g. renewables – solar, wind, etc.) are a mark of progress.
4)	'Soft' technologies involve a more frugal use of resources and are environmentally more benign. The co-ordination of a number of physical effects (*greenhouse, horticultural, apse, chimney, and heat-sink*) around the	

urban effect could save on resources like land, water, time, energy, minerals, and have a better ecological sanity. The application of the technology that supports these effects within a compact, three-dimensional urban structure promises a reduction in pollution, segregation, waste, bigness, bureaucracy, isolation, and alienation.

Sources: P. Soleri (1969, 1973, 1981, 1985) and D. Pepper (1996)

In the 1970s, when the 'ecological crisis' was still in its infancy two aspects fundamental to Soleri's work - the idea of 'planning' and the form of sociological analysis within 'structuralism' - were rejected in favour of the postmodern notion that we could choose to live our lives wherever and however we pleased. According to Soleri, it was during this period that architecture and its education system began to collapse. "Design freezes something...and people wanted to be able to choose at any moment of their lives".[8] In more recent years we have begun to realise that there are ecological limits to population and economic growth that are 'locked in' to physical and social problems of the urban environment and our attempts to define a sustainable society. We are less convinced that free-market solutions, characterised by unsustainable patterns of production and consumption, increased motorization and inefficient waste management, will optimise urban forms. The environmental imperative is rendering the whole notion of planning acceptable again and it has become more acceptable to explore the deeper structures that determine social relations within the built environment and develop related responses. The work of anthropoligists, like Claude Lévi Strauss[9] and cultural semiologists Roland Barthes[10] are, once again, fashionable in architecture schools

Critics have argued that Soleri's arcologies take Sant'Elia's and Le Corbusier's 'machine-age' cities to another level, suggesting populations of millions living a "beehive existence" in massive multi-cell units that "resembled the cooling towers of nuclear power plants".[11] Some have pointed out that they would need a technically advanced centralised society for their construction and maintenance. To Kevin Lynch (1991) the arcologies drawn in 1969 are "...marvellously compact and intricate. The large community and its high fashioned shell

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[8] Soleri cited in Stanishev, (1993), p. 61
[9] C. Levi-Strauss, *Structural Anthropology,* translated C. Jacobson and B. G. Schoepf (Basic Books, New York, 1963)
[10] R. Barthes, *Mythologies* (Paladin Books, London, 1973)
[11] Le Gates and Stout, (1996), p. 453

become a coherent super-organism, replacing the individual as the organized living entity"[12] but suggests that, like Le Corbusier's cities, arcologies would be alien places:

> ...the separations, the oversimplification, the pure aesthetics of the working machine, seem cold and repellent if we imagine ourselves actually living in these ideal places. They are founded on a conception of the city which seems basically wrong".[13]

Opponents explain away Soleri's arcology as a "communitarian nightmare: an environmentalist's anthill"[14] based on an ecofascist regime where no one can own a car, water their own lawn, or build their own house because these are deemed to be unsustainable activities. They are, of course, but these sort of activities have underpinned modern industrial culture for the last 250 years. And yet to others he is the perfect example of the "poet architect"[15] who is simply advocating a re-orientation of modern urban life towards, what he believes, is a more sustainable alternative.

Today, within the emerging ideology of ecologism, the relationship between sustainability and urban form is being recognised as of critical importance. This has re-awakened interest in Soleri's work and signals the most recent shift in the reception of his ideas. There are signs that his work is moving towards the centre of the new debate on sustainability. But there are certain 'problems' and contradictions within Soleri's thinking which tend to act against a more widespread acceptance of his theory, particularly in a cynical postmodern age that denies the sort of certitudes and rigid oppositions that Soleri bases his ideas upon: matter and spirit, growth and evolution, compaction and sprawl, Dionisian and Apollonian, gigantism and miniaturization. The Teilhardian tone, although it is central to his philosophy, can be a distraction to those who are intimidated or remain unconvinced by the theological dimension.

But although the 1960s frame of reference for staging his arguments is now rather dated, many of Soleri's ideas seem more relevant now than they have been in the past:

> The [arcology] idea is valid. It was valid 30 years ago when Paolo was a crackpot and it's valid now. Even more so when all his ideas are starting to come together. There are so many aspects of what he has talked about that are now happening: recycling, energy awareness, pedestrian access, mixed-use activities. All the parts are already there in society but they haven't been pulled together. To me it all seems so obvious that if you tie all of these together in the concept of arcology then it's going to work.[16]

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[12] Lynch, (1991
[13] *Ibid*
[14] Luke (1997), p. 165
[15] R. C. Smith in Borden and Dunster, (1995), p. 236
[16] Neil Urban cited in Mayne, *Soleri's Cities: Architecture for the Planet Earth and Beyond* (1993)

The importance of his underlying ideas on the relationship between ecology and architecture, and urban form and sustainability is now apparent but Soleri's anthropocentric outlook is clearly at odds with the general tendency within environmentalism, drawing on a view of nature held by philosophers like Spinoza and Heidegger that every being had the right to express its own nature, to reject the dualistic view of humans and nature as separate and different, and grant extended and deepened care for non-humans and humans alike.

This view has been promoted within *deep ecology* as the philosophical basis of truly green practices and lifestyles which aim not only at eradicating the harmful effects on human life of problems like 'pollution and resource depletion' but also express a deep concern for ecological principles like complexity, diversity and symbiosis. These are the same principles that underpin the arcology concept. The chief difference is that Soleri focuses on these as a way of supporting social structures and systems within an entirely new 'neonature' or human landscape.

Although arcology proposes a more collective means of transforming society, than deep ecology's transformation at the level of individual attitudes, values, and lifestyles, and Soleri would be at pains to distance his own approach from the 'millenialist' spiritual hotch-potch of *new ageism* he would, no doubt, enthusiastically endorse the broad thrust of the deep ecology platform in its desire to motivate supporters towards the depth of social changes needed to overcome the environmental crisis and to unite concerns for nature with a desire to transform society. He would also support the formulation of policies that will reach deep enough to ensure a global change from increasing to decreasing ecological unsustainabilty.

The arcology theory attempts to offer a pragmatic and meliorist model for radical social and environmental change. In Leo Marx's (1970) terminology it can appear caught between a *conservationist* viewpoint (where nature "exists apart from, and for the benefit of mankind"), and an *ecological* perspective (in which the built environment is inextricably "embedded in the tissue of natural processes").

If as Worster (1977) suggests, our fundamental task is to choose between an "arcadian" tradition with its simple (frugal) rural lifestyle in harmony with nature, or an "imperial" tradition and the deployment of science and technology as a means of extending our power over nature as widely as possible, then here again the arcological thinking suffers from an "identity problem" which sees ecology as *both* a "science of control and manipulation of the non-human" world *and* a "philosophy of interrelatedness". Soleri refuses to be forced into Rifkin' s (1983) rather simplistically stated choice between an engineering approach to the age of biotechnology or an ecological approach. Arcology aims at both and attempts, in its synthesis, to uphold the values of both.

O'Riordan's typology (1976) distinguishes between *technocentric* and *econcentric* approaches to environmental issues. In his terms of reference the arcology concept would fall within the technocratic ideology that upholds an "arrogant assumption" that we humans are able to understand and control events to suit our own purpose and improve the human condition by technological means. This would suggest that the arcology approach conforms to the dominant set of attitudes towards nature held in modern Western society. But according to O'Riordan, technocentrics foresee no radical changes in the current social, political, or economic structure. They accept the existence of environmental problems but either endorse the 'cornucopian' view that, they can be resolved and unlimited growth can be achieved within the current form and structure of society, or they can be negotiated by economic and environmental management. Central to both views is a faith in classical science, technology, and in conventional economic thinking. This is where Soleri parts company with the technocentrics. He sees human society as part of a global ecosystem that is subject to ecological laws and endorses an ecologically based morality. The arcological perspective endorses the ecocentric sense of respect for a nature in its own right as well as for pragmatic reasons. Soleri argues for 'soft technology', but is not against technology *per se.* He decries bigness (advocating miniaturisation) and impersonality in the city (promoting the urban effect) and aims at an urban system based on ecological principles of diversity and homeostasis. Arcology is, like ecocentrism, concerned with *ends* (eschatolgy) and the proper kind of *means* (the technology of transcendence). Conceptually it tends towards decentralised, democratic, communities while emphasising the idea of limits to growth. It advocates the use of 'alternative' ('soft', 'intermediate', and 'appropriate' technologies) considering that these are both environmentally benign and democratic.

Soleri's designs go against many contemporary environmentalists notions of living in harmony with Nature, and the traditional green interpretation of sustainable ecological development. He suggests that around twice the current global population could be accommodated on the planet if only the urban infrastructure could be altered to fit arcological specifications. While arcologies have been criticised for their "anthill" characteristics, Soleri has actually changed only a couple of the conventional assumptions of urban design: firstly he has removed the car from inside the city and prioritised pedestrians, and secondly he has shifted the urban structure into the third dimension from two-dimensional sprawl. His changes could signal a radical alteration of the city's ecological footprint but this needs to be proven. A million people in an arcology, might represent (or even ease) the same destructive global flows of capital, labour, energy, material, and ideas, as its deviant two-dimensional counterpart in Pheonix, or

Los Angeles. It may alter the local ecology, even improve immediate urban environmental problems but, in the end, leave the global environmental problems untouched.

Soleri apportions the blame for the two-dimensional sprawl of cities like Los Angeles and Phoenix almost entirely on the technology of the motor car, largely ignoring the impact of interventionist state policies during the Cold War era. The high-technology industries (space, aircraft, electronics) that have rested at the heart of the Fordist American defence economy and which have encouraged a particular kind of urban growth, escape Soleri's critique. The state subsidies which made possible the construction of roads for urban transportation, dams for electricity and water supplies, the availability of cheap housing, and met the escalating demands for food through inexpensive agriculture is drying up. The mass mobilisation of the human population has resulted in a new form of urbanised space. But it is one that lacks any real sense of organic community, of place, or of identity. Urban sprawl becomes the transitory habitat for a new nomadic society shifted from place to place under the directive of transnational corporations or governments in order to sustain the growth machines of the global economy. But the increasing migration of people and capital into the suburbs means that in many cities in the developed nations the urban core is being starved of economic and human resource. As the tax base leaves the cities for the suburbs, two-dimensional cities are struggling simply to survive.

The concentration of population and production in compact, three-dimensional urban structures could offer a form of settlement appropriate to the needs of a Post-Fordist political economy. To respond to the demands of global, rather than national, modes of high-tech production cities will require compact, flexible, inexpensive workspace and industry near to their population centres. The economic (wasted time/waste space) disadvantage, and the social and environmental degradation associated with urban sprawl and the infrastructure and architecture of the car culture will need radical rethinking. A modification of Soleri's arcology could be a step toward generating a more rational and sustainable relationship between production and consumption. By completely re-thinking the twentieth century industrial city from its infrastructure upwards, and beginning to reconsider the dynamics of human ecology, Soleri's marriage of technology with ecological conviction may offer, in the form of the arcology theory, one of the more realistic communitarian responses to the environmental challenge of our age.

Ecological design is not a new idea. Ecological architecture must learn from the past and needs to guard against the notion that we must 'destroy the village in order to save it'. Many different cultures within widely varying conditions around the world have, through necessity, refined approaches to integrating with the surrounding environment on which they depend for their sustenance. Even during the uncritical growth eras of the industrialised nations, there have

been strong movements for ecologically sound planning, healthy building, organic agriculture, appropriately scaled technology, renewable energy, and interdisciplinary approaches to design. William Morris's Arts and Crafts Movement, Ebenezer Howard's garden cities, Patrick Geddes's and Lewis Mumford's regional planning, Antoni Gaudi's organically inspired reinterpreation of the Gothic, Erich Mendelsohn's search for new Expressionist forms, Frank Lloyd Wright's organic architecture, Rudolph Steiner's *biodynamic* design methods, Buckminster Fuller's Dymaxion (*dynamism plus efficiency*) proposals, Wright apprentice Richard Neutra's *biorealism* linking architectural form to human health, Alvar Aalto's regional approach reflecting climatic and traditional imperatives, Bruce Goff's architectural experiments with geometries and materials.

By the 1960s resistance to the unfettered growth of industrialisation crystallised into the first modern generation of ecological design. The house was the most familiar place to start defining a new kind of architecture based on alternative lifestyles. The development of independent energy sources from wind, sun and water was recognised as being essential. Research into these technologies that had been conducted for years within the military establishment, was disseminated through such publications as *The Dome Book* and Stewart Brand's *The Whole Earth Catalogue.* John Todd at the New Alchemy Institute designed Solar Arks that grew their own food, provided their own energy, and recycled their own wastes. A group at Cambridge University School of Architecture, led by Alex Pike, developed a research project looking into the design of a self-sufficient house. The *Autarkic House* sought to create a model dwelling that could provide a lifestyle appropriate to the late twentieth century but with minimal external support. It utilised all the latest technological developments, including solar collectors for space heating, wind and methane generators, and greenhouses for food and oxygen production. And Paolo Soleri, with the help of students from Arizona State University, was building his Earth Houses at Cosanti and drawing up proposals for Arcosanti.

The early experiments in ecological design were small in scale. Many of the pioneering technologies, such as alternative building materials and techniques, renewable energy, organic food production, conservation, and recycling have been adopted in recent years in a piecemeal fashion in different parts of the world. We now stand at the threshold of a new generation of design that must effectively draw together all the strands of ecological thinking from many different disciplines, practical experiments and theoretical propositions, and offer holistic alternatives that operate within a new paradigm that seeks a sustainable future. Engineers, social scientists and architects need to work alongside local authorities, businesses and communities to develop a new from of comprehensive urban planning that could initiate a new and dynamic

equilibrium between society, cities and nature. There now exists considerable consensus about the kind of things that need to be done - improving energy conservation, reducing car dependence and in a shift towards more compact city forms, with higher residential densities and mixed land uses.[17] The search is underway for different approaches, models and forms that can respond to the variety of existing settlement patterns. We need as working examples as possible.

Such practical, ecologically aware projects, are important both for their role as prototypes and in resolving specific problems within laboratory-like conditions. They offer the possibility of not only of theorising but of demonstrating how we might move towards a more sustainable way of life. Simply looking to alternative ideas and ideals will not of itself be sufficient. The political challenge within ecologism must be to combine ecological ideas and values with proposals that are practical and workable. This is why working models, particularly those with some degree of experience and history, like Arcosanti, are of real value. As our understanding of the damage we are inflicting upon ourselves becomes clearer, current assumptions regarding what is the most environmentally benign materials and construction methods may alter but we need laboratories where we can test current and future criteria against specific criteria. Where we can make mistakes and learn from them. In any case it is likely that no absolute or universal solutions exist. Because we are something essentially "on the way" perhaps ultimately it is more a question of moving in the right direction.

The *urban laboratory* at Arcosanti is where, by trial and error, the basic physical and cultural tenets of the arcology theory are today being tested and refined. The stated priority for the experiments lies in the definition of a physical structure, which would be indispensable for the "social organism" that would eventually inhabit it. The aim of the architect has been to design the best possible urban instrument. This has involved the creation of an environment where the social, cultural, agricultural and industrial processes, and the associated production of energy, are being intensified while, at the same time, limiting the impact of the settlement on the natural environment and minimising its consumption of natural resources. It is a place within which a whole range of social experiments are taking place. Arcosanti represents an attempt to address questions of the ecological sustainability of cities, while demonstrating a deep commitment to ecological ideas. Whether the project represents a workable alternative with a wider application, in effect, a step closer towards a more socially and environmentally sustainable city or the illegitimate foolishness of a megalomaniac, will depend upon testing the conceptual foundations

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[17] Haughton, (1999)

of arcology. Since Arcosanti has existed as a working prototype since 1970, it should be possible to examine how successfully the theoretical response has been implemented.

Construction work has been, at times, painfully slow and has largely been financed by the sale of the bronze and ceramic wind-bells (15,000 produced per year) and tourism. This sustained effort has been undertaken by the 'unskilled' Arcosanti community themselves, which has variably numbered between 50 and 100 residents supplemented by the labour of around 20-30 'workshoppers', arriving (and departing) every few months throughout the year. This grassroots approach to building has allowed Soleri to keep a close control of the project's development but independence has come with a price. The political economy of democratic capitalist societies does not support or encourage community living. The practical exploration of this kind of model requires a new method, which invariably means going against the grain. Problems with conventional sources of finance are inevitable.

While it lacks ties to other industries, markets, and other sources of information it cannot become a real city. Arcosanti remains more of a village and is still struggling to become economically self-sustaining. Although Soleri has chosen the independent path he expresses disappointment that there has not been more support over the years:

> When we started I thought that there would be the beginning of a response through a number of things - finances, corporations, people, and so on. This hasn't happened. Part of the reason is that I am not exactly advocating the American Dream, quite evidently from the very beginning. So it's very difficult to go to someone and say 'You're mistaken. I'll tell you what the truth is. Give me money'. It doesn't work that way.[18]

While Arcosanti's orientation is towards transcendence and the achievement of an end in "a fully conscious Universe" it is not a countercultural, sectarian or religious establishment. Neither is it a meditation centre or a neo-monastic retreat. Since he adheres to the hypothesis that reality is a process of creation, and "truth is in the making" (is yet to come), Soleri argues against "idolatry, intolerance, fanaticism, or cultism" and sees no use for the notions of "the chosen people, the perfect society, the Garden of Eden, utopia, paradise".[19] If it were to be, or pretend to be, that which it seeks it would be "senseless, insane, and moronic".[20] Rather, as an urban laboratory, Arcosanti tries keep "its ear to the ground physically, theologically and aesthetically" as it attempts to define at a working model, a prototype, that might be influential in changing the social and environmental conditions of the present while aiming at an ideal and unknowable society that might inhabit it in the distant future. Arcosanti, in Umberto Eco's (1986) terms might

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[18] Soleri cited in Mayne, *Soleri's Cities: Architecture for the Planet Earth and Beyond* (1993)
[19] Soleri, *Technology and Cosmogenesis* (1981), p. 75
[20] *Ibid*, p. 105

be seen to exhibit the symbolic importance of architecture by accommodating both its "variable primary functions" (its conventional use as living/working/learning community) and its "open secondary functions" (symbolically as a prototype arcology).[21] Arcosanti is "a quest for what it does not have".[22] In this way the laboratory becomes both the "media" and the "message". But while it fulfils the secondary function of architecture in acting as a symbol it's also a real place where people will have a future simply because they are building one. Those who live, work and learn there know that they're in the middle of something that is essentially 'on the way'. After thirty years, volunteers are still there, still pouring concrete. There's no desperate rush. There's no evidence of the bandwagon of despair, just a daily work program and a quiet pervasive hope.

Sustainability, Arcology, Arcosanti and Utopia

Humankind is now entering a new stage of development in which a reformulation of the relationship between society and the environment is taking place. There are the first signs of a new ecological era as different levels of government, industry, and various social and economic institutions are mobilising for a sustainable future. In the growing awareness of the importance of environmental problems, in an expanding willingness to act in the interests of the environment, and in the growth of environmentally sound behaviour, we seem to be witnessing a process of social mobilisation against the deterioration of the environment, i.e. the basis is being laid for the restructuring of society in the direction of an ecological society.

Social reconstruction implies a redefinition and remodelling of all that, until now, was considered 'normal' and 'usual'. The idea that industrial production and economic growth could last forever and that we could carry on indefinitely extracting natural resources and burning fossil fuels is giving way to a new way of thinking that recognises the existence of limits and consider that the wasteful use of energy and resources and the emission of environmentally polluting substances constitutes 'deviant behaviour'. This process of redefining of our 'normal' modes of behaviour is impacting on all aspects of our lives; production, consumption, transport, leisure, and housing. But because there are signs of hope does not mean that we are near to reaching our goal of a sustainable future. Without doubt the signs of despair, witnessed by an increasing number of global and local environmental and social problems, are more numerous than the signs of hope. We have it seems simply reached the beginning.

Most political parties in Western Europe acknowledge that environmental problems are serious and numerous, and that policy must be directed towards sustainable development. But,

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[21] Eco, (1986)
[22] Soleri, *Technology and Cosmogenesis* (1981), p. 105

since the concept has a variety of meanings and divergent interpretations, it remains unclear which direction society must take in order to achieve sustainability. Indeed the idea of sustainable development remains so vague, and it contains so many contradictions and paradoxes, that it is still uncertain whether it can be used as a guideline for policy making. Confused definitions, a limited understanding of the range and scope of environmental problems (both globally and within cities), and research that has tended to focus on individual parts of the problem, like energy or transport (rather than taking an holistic approach), mean that we have yet to provide adequate responses to the question of a more sustainable urban form. In considering the restructuring of existing cities and conurbations, Hildebrand Frey (1999) has recently presented and evaluated six different city models (Core City, Star City, Satellite City, Galaxy of Settlements, Linear City, and the Regional City) based on the work of Kevin Lynch (1985), John Minnery (1992), and Peter Calthorpe (1993). Frey tests the viability of these models in terms of their potential performance based on the sustainability characteristics described earlier in Volume One. These include :-

- degree of containment of development;
- population density relative to land need;
- viability of public transport;
- dispersal of vehicular traffic;
- viability of mixed uses;
- access to services and facilities;
- access to green, open spaces (parks, countryside);
- potential for social mix;
- potential for self-sufficiency;
- imageability of the city (the physical entity) as a whole;
- sense of place and centrality.

Frey concludes that all of the models may well play a part, on their own or in combination, in defining a sustainable city region. Strategies for improvements will, however, be dependent upon the characteristics of the particular city or region and might have to be different in each case.[23]

In offering a methodology for the reorganisation of urban sprawl into dense, integrated, compact city structures, Paolo Soleri's arcology model shares many characteristics with Lynch's Core City model (1985, pp. 373-4) with respect to high density levels and the intense peak of

activities in the urban centre. Reminiscent of the medieval city, although much larger in scale, an arcology would be highly imageable and provide a strong sense of community. If its size and population remained relatively low an arcology, such as that slowly emerging at Arcosanti, would have undoubted advantages in terms of travel distances, increased access to facilities, and proximity to the countryside. But if grew beyond a certain dimension and size of population, major problems could arise involving massive congestion and pollution (Frey, 1999, p. 47).

At least in theory, the arcology model promises to respond favourably to many of the more technical environmental problems described in Volume One. The employment of combined energy and waste systems within such compact urban agglomerations offers the potential of large-scale reductions on energy use, waste and pollution. The problem remains one of evaluation and Frey acknowledges the need for multi-aspect and multi-disciplinary research in the field of the 'sustainable city'. He argues that the complex issues of a sustainable city will not become more tangible unless we can develop laboratories to test micro- and macro- structures of the city and test sustainable parameters. Without such centres of investigative research, he suggests, the complex issues of sustainability will continue to rely on assumptions.

The 'urban laboratory' at Arcosanti offers this kind of environment but its setting, in the wilds of the Arizona desert, appears to be at odds with its primary function, as a locus of *urban* research. Nevertheless since 1970, Arcosanti has attempted to test the validity of the arcology theory through architectural, environmental, and social research on a micro-level. It follows in the tradition of a multitude of experiments in libertarianism , from the Owenite and Fourierist experiments of the early nineteenth century to the libertarian counter-cultural communes of the 1960s, such as *Drop City*, Colorado and *The Farm* in Tennessee, to the profusion of ecovillages, organic farms, and cohousing communities around today. While it my be a source of frustration and disappointment to many closely involved with the project (not least Soleri) that progress has been slow, the 'small experimental' nature of Arcosanti is in keeping with the contemporary Green movement's idealist strategy of change through 'force of example' to pave the way for wider social and environmental change.

From the Centre of Technology (CAT) in Wales to the New Age community at Findhorn, Scotland, much of the practice of much Green politics takes the form of a series of small experiments. Ronald Creagh, in his study *Laboratoires de l'Utopie* argues that there are problems that can only be faced through investigation on the micro-social level.[24] He shows that intentional communities confront a multitude of questions related to interpersonal relations and

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[23] Frey (1999), pp 37-68

[24] R. Creagh, *Laboratoires de l'Utopie: Les Communautés Libertaires aux Etats-Unis* (Payot, Paris, 1983)

everyday life. But this also raises the problem of persuasion that confronts the whole environmental movement. People are required to think in global terms and with respect to events that may, or may not, take place in the future. It might be argued that it is only those people who already live in sustainable communities that think like that. If they constitute a vanguard, it is difficult to see how they are, under present conditions, going to attract large numbers of people to their cause. Porrit (1984) suggests that Green strategies for change have not yet brought about the fundamental shift that might have been expected. In terms of the questioning of current social and political practices and the presentation of alternatives, the growing middle class may well have a central role to play here.

Soleri's view that Arcosanti is largely an informational construct is perhaps born of necessity rather than desire. Physically it continues to be built by unskilled volunteers and largely funded through the sale of the wind bells that are made there. Over the last 20 years the number of residents has decreased so that today a small community of around fifty or sixty people is occupying spaces planned for five to six thousand. The lack of human and material resources and the "unprofessional" level of operation means that it is proving difficult to be convincing when offering Arcosanti as a prototype of urban sustainability. The slow pace of progress and the modest nature of the construction programme has led some to liken Arcosanti to some bizarre living history village from the 1960s vividly demonstrating everything that modern consumerism associates with the 'cliché' of the "small is beautiful" and "voluntary simplicity" ethos of the hippie generation.[25] The real paradox is that, while it may be experiencing something of a 'virtual renaissance' on the Internet, physically Arcosanti is languishing. Unless it can attract a living society to maintain it by putting its energies into its construction, and an operational political economy that would help in its realisation Arcosanti may yet prove how limiting a purely informational economy may be. Jean Baudrillard (1988) wrote of Arcosanti that it "gathers together all the 'soft' technologies in the heart of the desert" [26] The intended scale of Arcosanti, particularly since it offers potential solutions to the challenges of urban sustainability would seem to require corporate, or state agency to raise the capital, labour and materials that would see it operate, and would demonstrate on a larger-wide scale some of the ecological principles inherent in the concept. Unfortunately under current conditions, neither Soleri nor Arizona State are willing to allow this to happen.

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[25] Luke, *Ecocritique* (1997), pp. 152-243

[26] J. Baudrillard, 'New York' in *America C. Turner* (translation), (Verso, London, 1988), pp. 2-3

The issue of Green social change is dogged by the necessity to distinguish between various manifestations of the environmental crisis. Clearly there are problems of a global nature that require a different strategic response from those of a personal, immediate and local nature. It also appears self-evident that actual sustainable communities are vital as sources of inspiration for the rest us to learn how to live in a more environmentally benign way. But the scale of global and urban social and environmental problems is such that bringing about a sustainable society is an infinitely more complex and difficult task than simply placing environmentalism on the political agenda. We need visions of what a sustainable future might be like.

In *Virtual Light* (1984) William Gibson describes 'The Bridge' as a place within which a whole range of social experiments can take place.[27] Gibson raises the issue of how to imagine alternatives to current urban trends which appear to lay the dead hand of 'zero tolerance' on any form of difference from prescribed social norms. These are questions which are neither often nor successfully dealt with in urban theory. An overemphasis on the social rather than the physical landscape of the city makes vision, in the sense of what can be seen, difficult. A social vision for the city has to have some sense of the physical sites, how they might look and what they might symbolise. Gibson's 'Bridge' represents an attempt to redefine the goals of modernity and address questions of the sustainability of cities.

Soleri's position states that, 'life is in the thick of things'. The "living process" is immensely complex and ever intensifying and creates conditions in which particles of physical matter begin to act in ways which are organic and living, and eventually instinctive, self-conscious ad spiritual. He believes that, in the transformation of the organism from the simple to the complex, matter is becoming spirit. His own 'bridge' involves an architecture which speaks of the "supremacy of aesthetics over structure and technology" (Moholy-Nagy, 1969). For Soleri, *The Bridge between Matter and Spirit is Matter Becoming Spirit.* It is essentially something which is 'on the way'. This aspect of his theory is clearly a utopia of transcendence.

From Plato's *Republic* and Lao Tzu's *Tao te Ching,* utopias have had a long history both in art and literature and as political practice aiming at vast social transformation. In offering alternative visions of the future, many artists, architects and planners have approached the problem of defining a better society from their own unique point of view. Through the ages, many have attempted to re-define society by starting from a physical rather than an ideological base. During the twentieth century architects such as Tony Garnier (*Une Cité Industrielle,* 1917); Le Corbusier (*La Ville Contemporaine*, 1922 and *La Ville Radieuse*, 1933); Frank Lloyd Wright (*Broadacre City,* 1934), Consatantin Doxiades (*Ecumenopolis*, 1969) and Paolo Soleri

(*Arcology*, 1969) have been committed to the discovery of the 'ideal city' through their architecture, rather than trying to express other people's visions.

In *Collage City* (1978), Rowe and Koetter distinguish between two principal versions in the "classical" utopia "inspired by universal rational morality" and in the "activist utopia of the post-Enlightenment". The vision of the Renaissance ideal city with its basis in rational order and geometric purity, offers the model of the classical utopia as essentially a "city of the mind", or a reference point, but not necessarily a prescription or blueprint. Such utopias are appealing in part because they allow the reader to fantasise about an ideal world. In this context, Karl Popper, one of the harshest critics of utopias, speaks about 'aestheticism' as a deep longing to imagine a society that is not only more rational than the existing one, but one that has been relieved of all ugliness and constitutes a truly beautiful new world.[28]

Soleri's anticipatory model of perfection , in which art is seen as an agent of transformation, promises not only the emancipation of the human spirit via metamorphosis ("esthetogenesis"), but the infusion of the non-living world with spirit (via the "complexity-miniaturization-duration" paradigm). But just exactly how it is that a painting, or a piece of sculpture, or a building, or a city (via "the urban effect") can bring about the transfiguration of "matter into spirit" is not explained in his mingling of theological speculation, construction theory and eschatological design. Clearly Soleri's intention is that ideas of ecology and architecture need to be re-thought as conjoined pieces of our theological and technological evolution, wherein the 'ecological city' becomes an integral part of the human evolutionary process. But he tries to invest in architecture and urban design a form of sacredness, which seems utterly alien to the urban complexes of the modern city. At Arcosanti the experiments in alternative urban technology (energy conservation, waste recycling, the use of renewable energy) or even the expression of communitarian resistance can become subsumed within an ethical struggle for the physical enactment of spiritual enlightenment.

Despite its theological dimension, it is in the re-casting of the relationship between society and nature that arcology conforms to the "classical" utopian typology. And here, the positive utopian energies of Soleri's work need to be acknowledged and affirmed. Perhaps his most important contribution is in beginning to rethink human ecology and encouraging us to re-conceptualise the extent of the human impact on the natural environment. A special power of the utopia is its ability to present political and social ideas in an unusually imaginative way, functioning as bearer of a vision and offering inspiration for those with a desire to look forward

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[27] W. Gibson, *Virtual Light*, (Penguin, London, 1993).
[28] K. Popper, *The Open Society and its Enemies* (routledge and Kegan Paul, London, 1974), p. 165

and gain insight into a feasible imaginable future. Despite the economic, social and technological uncertainties, utopias dare to paint a futuristic picture of society and offer readers a glimpse into 'their own ' future. But perhaps their greatest attraction is that they stimulate us to think in a participatory way, and therefore encourage reflection. The reviewer is forced to take a stand and critically reconsider his opinions about the most desirable way in which the economy, society and the state should be organised. Utopias, in this sense, act as a 'critical norm', developing criteria with which to measure current social development. They can stimulate theoretical experiments, encourage attempts to break through fixed patterns of thinking and test unorthodox combinations of ideas.

Soleri offers arcology as instrumental in achieving a different social order and, in so doing, encourages a wholesale re-evaluation of the extent of our impact on the natural environment. [29] By promoting a different kind of urban model, Soleri envisions the possibility of re-naturalising the natural environment. In this sense, and in combination with the recent focus on information technology through the *Paradox Project*, it can be argued that arcology is contributing to radical ecology's mission of world disclosure.

The idea that there is value in inventing a detailed model of a society without the shortcomings and disadvantages of the current political system has been popular since Plato described *The Republic* (427-347 BC). The utopian philosopher attempts to construct an ideal society at some distance from present reality, in order to discover untried and unprecedented possibilities for the future. Utopia is literally 'nowhere land', a perfect society in 'another place', where justice prevails, everyone is happy, and sadness, pain, and violence are banished. Utopias are characterised by a detailed description of the envisioned society that often includes a 'blueprint' for a completely new state, along with a critique of the current society. Urban utopias express above all the need to construct a conceptual framework, from which a better reality than the current one can be physically shaped. Rowe and Koetter (1978) describe the "activist utopia of the post-Enlightenment" as the Neo-classical vision of the ideal city that, unlike the "classical" version, is meant to be implemented by applying rules that will make the city work better. This activist tradition has influenced the utopia of the Modernist City, through the

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[29] In the *Neuromancer* trilogy of 'dystopian' novels the author William Gibson describes the city of the future as "*corporate arcologies*" [my emphasis]. These he describes as highly integrated urban structures standing in opposition to the "Sprawl" that stretches over continents.[29] Indeed such transnationalised high-technology structures already exist but, in their current form, they consume huge amounts of land and energy transporting people and goods over their vast expanses and are the major protagonists in the ongoing degradation of life on Earth. Their own megamachineries have so transfigured and disfigured the natural world that, for the majority of humans and an increasing number of plant and animal species, *they are the environment.*

Futurists, Garnier, CIAM and Le Corbusier but has been found wanting in its formal and functional naivety, its simplicity, and its inadequacy to deal with the pluralist complexity and creative contradictions of the Post-modern world. Such utopias have been particularly at odds with a period that has been characterised by pragmatism, and a lack of belief in ideologies and idealistic political visions. In *The Open Society and Its Enemies* (1974), Karl Popper criticised utopianism for attempting to devise a 'blueprint' for the Ideal State, to which all political activity should be subordinated. Today the notion of utopia as a blueprint or a fixed model of the future has been rightly rejected.

Paolo Soleri was awarded a special prize by the Congress on Utopia in Italy in 1989.[30] His response was to write a paper saying why it is that he rejects utopia. He wrote "utopia is for everybody or it is nonsense".[31] Science and religion tell us that we cannot isolate a phenomenon and consider it autonomous, self-sufficient and perfect. Soleri is critical of the idea of 'self-sufficiency'. "...the difference between utopia and what we are trying to do", he says, "is that I do not believe in perfection".[32] But there are contradictory elements in arcology and Arcosanti where various ideologies and utopias intermingle. The 1969 arcologies, which at first seem to offer the, as yet, unrealised dreams of a new society, when examined in more detail can be viewed as ideological narratives that reinforce some of the myths of the present social order. Although described in the context of 'miniaturisation' these early projects appear as megamachines, designed for the efficient and rational restructuring of urban economies and societies within a new metabolism that is bigger and intended to last. Rational and logical construction on such a massive scale, is difficult to imagine, and appears shocking and alien. In the tradition of other hi-tech megastructural solutions like those of Buckminster Fuller, the Japanese Matabolists, and Archigram, Soleri's early arcologies are clearly technocentric, suggest a rejection of the genus loci, are based on a spectacular degree of technological progress and the benefits of industrial production. They therefore offer an unconvincing path for society's ecological salvation.

In casting arcologies into 'unspoiled' bioregions (i.e. the Arizona desert) and presenting the arcological alternative as a futurology for tomorrow, Soleri seems to be picking a fight that cannot be won and at the same time revealing a lack of appetite for the battle that must be won in

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[30] The *Utopus Award* was presented by the Third International Conference of Utopian Studies at the Universita Degli Studi di Genova in Reggio Calabria, Italy.
[31] P. Soleri, "Transforming the Urban Condition" in C. Zelov and P. Cousineau, *Design Outlaws on the Ecological Frontier* (Knossus Publishing, Philadelphia, 1997), p. 245
[32] P. Soleri cited in Stanishev, (1993), pp. 58-63

the existing city. He ignores the possibility of materially improving existing cities and conurbations by, for example, directing arcological thinking towards retrofitting existing cities with 'arcological implants'. There are opportunities for transformative experimentation within existing mega-cities that would benefit from this kind of arcological retrofitting. A series of smaller interconnected arcological structures could be proposed which would attempt to address the ecological recovery of the existing environment. Rather than avoiding confrontations on the prevailing approaches, and appropriate policy measures needed to address agreed sustainability criteria, why not become part of the political struggle for social and environmental change by trying to force the existing urban structures to become less irrational and more idealised and concentrated 'arcologies'?

Arcosanti has been dismissed as a "true" utopia because it has been located in the middle of nowhere with no industries, little arable land, few transportation links, and hardly any people. Soleri argues that it will be in harsh and difficult environments, such as this that the new settlements of the future will be constructed. As it stands however, and even when complete, it will be the antithesis of all the benefits of modern suburban living (mobility, luxury, consumerism). Arcosanti will lose out every time against Phoenix because, while it may be what an ecological society needs, it is not what the customer wants. The myths of modern life in the city, when seen from an ecological viewpoint, may well be full of false promise but Arcosanti's misfortune may be to stand as tangible proof of an ideology of frugality that most of today's suburbanites fear most. In this sense, for many it may well be an undesirable utopia.

Despite the reservations there are, however, positive benefits within the utopian tradition that need to be acknowledged and affirmed. Rather than take the existing order for granted utopias offer a break in historical continuity and the promise of a fresh start. They avoid halfway measures, modest compromises and cautious plans of action. They start with a more or less clean canvass and defiantly paint a new society that claims to eliminate all the deep-seated causes of social malaise and so create a better world right from the start. By reflecting a happy world in the imagined past or the distant future they also hold up a mirror to their contemporaries to draw attention to the injustices and shortcomings that may have gradually become ingrained in society and which, we have long failed to notice. In this way utopias can help us to observe more accurately and therefore foster a heightened insight into our social reality.

Now that the relationship between sustainability and urban form is being recognised as critical, Green parties might be better placed to contribute to the wider social debate on sustainability by referring both to classical and recent "ecotopian" thinkers. Looking to

alternative ideas and ideals, however, will not of itself be sufficient. The political challenge involves the combination of ecological ideas and values with proposals that are workable. Eckersley (1992) in *Environmentalism and Political Theory* recognises the value of the utopian tradition and the importance to the search for a sustainable society of both theoretical reflection and practical experimentation:

> To be realized, the aspirations released by utopianism must be critically related to one's knowledge of the present, thereby uniting desire with analysis and leading to informed cultural, social and political engagement. The ecocentric Green movement needs idealists *and* pragmatists, creativity and critical analysis, grassroots activity *and* institutional support if it is to achieve its long-term aims.[33]

The environmental movement will be letting an opportunity pass by, by not recognising the value that lies in the utopian tradition. Seeking out hopeful visions is particularly important in an age when we seem to have lost faith in the future. In an address to the Fifth Alvar Aalto Symposium in 1991 Juhani Pallasmaa contrasted the optimistic spirit in the artistic and cultural avant garde within La Belle Epoque, Art Nouveau, and De Stijl, a hundred years ago with our recent pre-occupation with 'endism'.[34i] Now, he said, "...we simply do not know what to expect and what to hope. We have lost sight of our horizon and our curiosity about the future. Instead of being excited we are worried". At a time when choices need to be made and reflection about the future is imperative, utopian-ecological insights can lend support to the consideration of alternative futures and the search for a more sustainable form of society.

Today Green political parties, in addition to analysing the causes of environmental problems, are concerned with the development of renewable ecological visions and in putting flesh on such concepts as 'sustainable development'. But much of their energy and attention currently goes on preserving the government's environmental policies and devising concrete solutions and suggestions for highly specific problems. It is possible to find holistic visions, as well as evocative images of a sustainable society, in the so-called 'utopian tradition' within the history of political theory.

> ...the utopian vision provides the indispensable fundamentalist well of inspiration from which green activists, even the most reformist and respectable need continually to draw. Green

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[33] R. Eckersley, (1992), p. 186

[34] American philosopher Arthur C. Danto, in 1990, announced "the end of art'. Hans Belting has spoken of "the end of art history". In 1990, Alvin Kernan, the American professor of the humanities published *The Death of Literature.* In 1967 the French composer and conductor Boulez said, "Blow up the opera houses." More recently, in 1989, the American political historian Francis Fukuyama brought the notion into a wider context in a controversial essay, *The End of History.* And in architecture Peter Eisenmann brought the discussion of the end towards its ultimate topic, in his article, *The End of the Classical: the End of the Beginning, the End of the End."*

> reformers need a radical alternative picture of post-industrial society, they need deep ecological visionaries, they need the phantom studies of the sustainable society, and they need, paradoxically, occasionally, to be brought down to earth and to be reminded about limits to growth.[35]

A common misconception about Paolo Soleri's work is that years of introspection have produced some kind of fixed solution to the problems of the city and that he has spent the rest his life trying to convince us of his approach. Instead, as described in Chapter 8 (8.6), he has been developing a methodology and through the years has been attempting to illustrate it. Soleri now emphasises the experimental nature of Arcosanti and the need to understand the city's role in redefining the American Dream, by making it more frugal and less materially orientated. But rather than support the idea that communes or utopias can break away from society, he now favours the notion that, through investigation and experimentation within a living, working and learning community (an 'urban laboratory'), new and useful patterns for society can be identified and used as a guide towards new action. Arcosanti is not being constructed according to a fixed predetermined plan but has evolved, as the theory that underlies it has evolved. While its function remains consistent with the stated aim in 1969 of providing "a self-testing school of urban studies", efforts have, since the *Two Suns* approach , been concentrated on defining various architectural effects that, when combined, offer a response to many of today's environmental problems. Over the last ten years, as the criteria of urban sustainability have become more widely accepted and understood, in short, the relevance of the Arcology model has become clearer.

If our society is to be sustainable, human imagination, ingenuity, energy, and labour must be directed to the building (and reconstruction) of cities that future generations can inhabit within an improved ecological setting. As governments, eager to deliver major environmental improvements, press on with as yet untried and untested 'centrist' urban policies, there is a need to research relevant models of compaction. Arcology's methodology recognises the need for the radical reorganisation of urban sprawl into dense, integrated compact urban structures in which material recycling, waste reduction and the use of renewable energy sources are part of a sustainable strategy aimed at reducing the flow of resources and products through the urban system. New social movements, environmentalists and existing urban communities, in an attempt to construct a more sustainable society, might look to these ideas as they are being tested at Arcosanti.

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[35] Dobson, (1990), pp. 206-7

But because it currently lacks the level of funding and resources that would see it grow in scale as a fully operational living, working community of five to six thousand, it is difficult to be convincing. The real value of what Soleri is doing at Arcosanti is, therefore, not so much in defining a specific prototypical *solution* but in offering both a 'critical norm' against which we can measure existing urban milieus, and an activist engaged strategy that advocates the possibility of building our dreams and visions. In a world plagued by so many problems, with so few alternatives, this may be the most important lesson of all. Arcosanti offers a beacon of hope for a sustainable future.

So this morning at a meeting held around dawn in front of the project's *Main Vaults* a small group of people will have been discussing the daily work programme. Others can decide whether the work is experimental or utopian, "a science fiction fantasy, an Orwellian nightmare, or a new evolutionary stage in the progress of the human spirit"[36] For them it is unfinished business and they will measure their own "progress" by the amount of concrete they will manage to pour today (see Plates 43 & 44).

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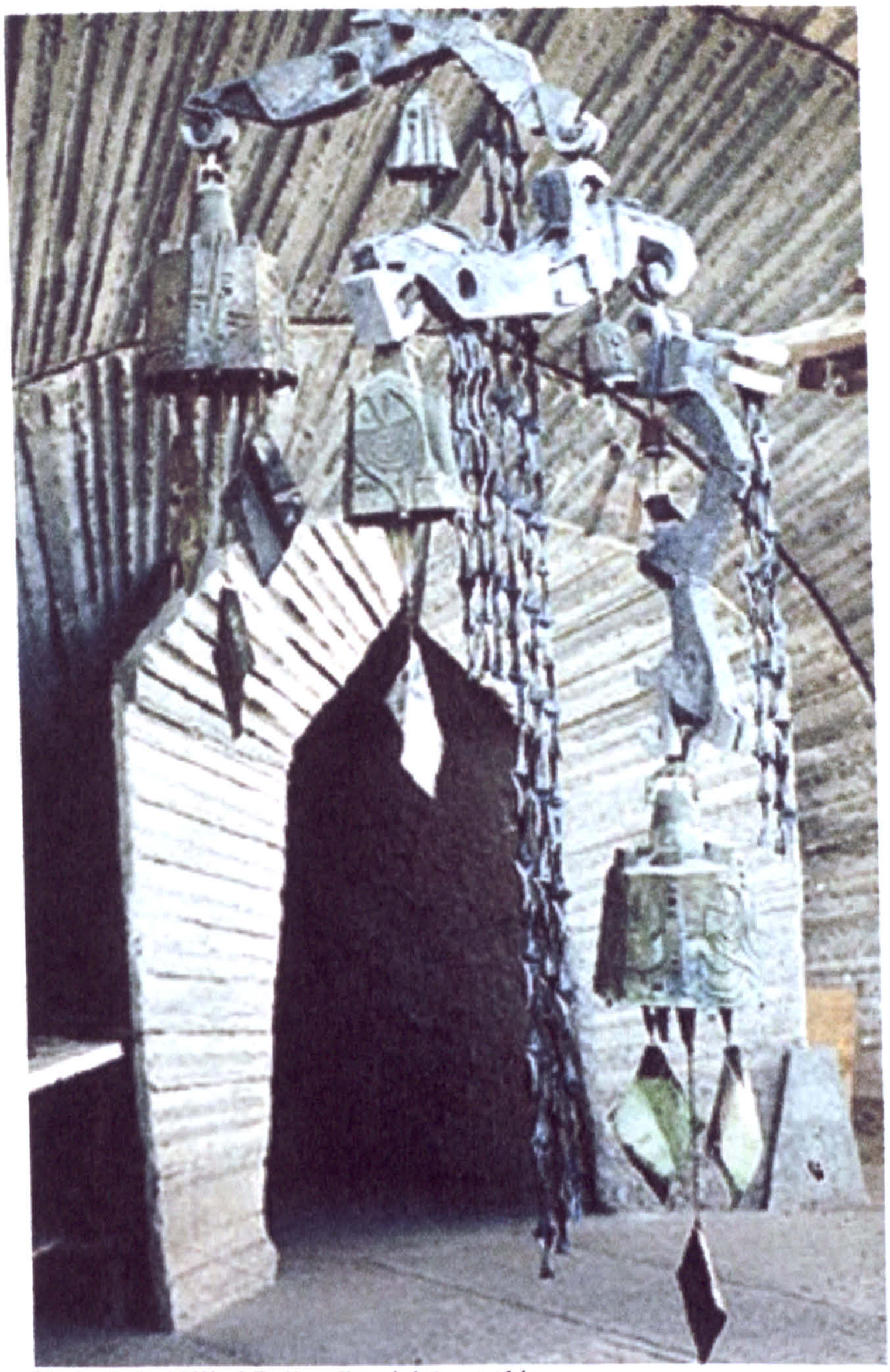
[36] Le Gates and Stout, (1996), p. 453

Arcology and Arcosanti
Illustrative Plates



Paolo Soleri Wind Bells - Special Assembly

The following plates have been included to illustrate the various aspects of the arcology model discussed in the text and to show examples of the architecture at Cosanti and Arcosanti. They are reproduced here along with a cautionary comment. These do not constitute a visual "blueprint" for the sustainable city. Rather they exemplify one alternative to the current pattern of urban sprawl. Due acknowledgements for the use of the images go to Paolo Soleri, Tomiaki Tamura,, and the Cosanti Foundation.

Plate 1 Turnsole House (1948) Elevation

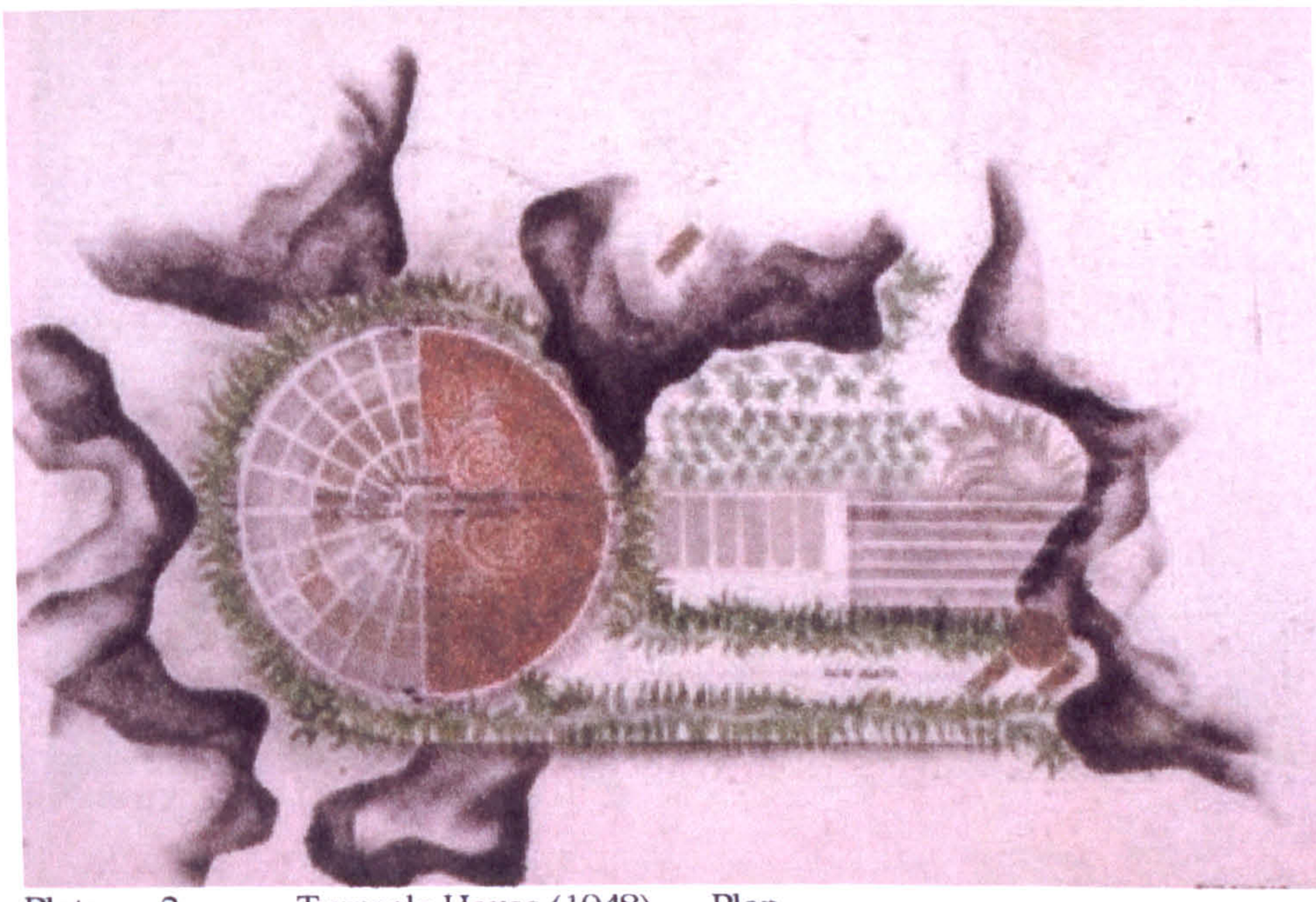


Plate 2 Turnsole House (1948) Plan

Designed by Soleri in 1948 the drawings of the*Turnsole House* indicate a glazed dome section over the living area. This would later become a major design element in the passive heating and cooling system developed for the Cave Creek *Dome House* (1949)(see*9.2.1*). Frank Lloyd Wright criticised Soleri's early work for being "all *on* the plateau, not *of* it" and saw him as more the brilliant painter than the Architect" (see 8.3).

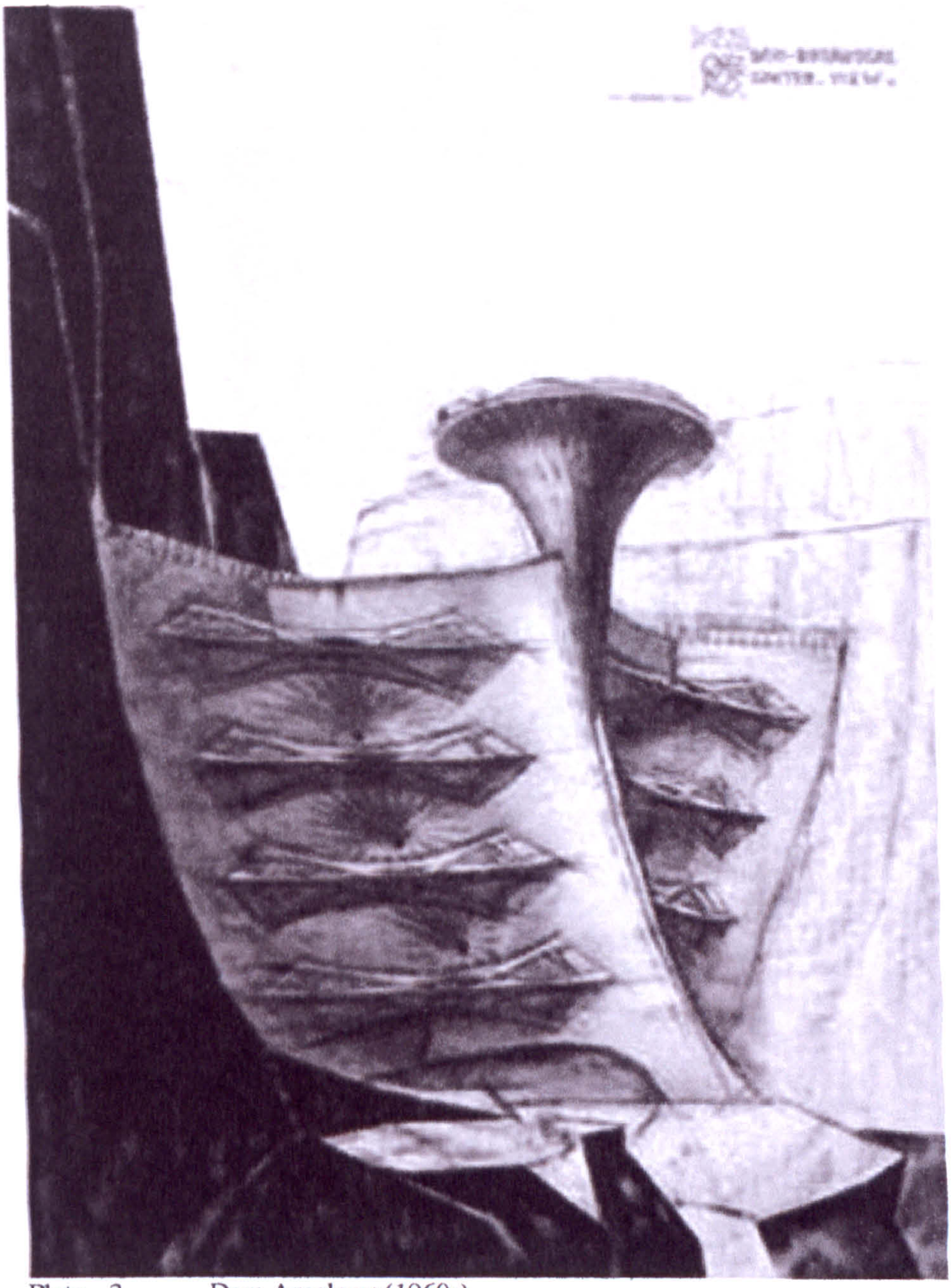


Plate 3 Dam Arcology (1960s)

Unlike Constantin Doxiadis' *Ecumenopolis* (1969), which proposed that the solution to urban problems lay in the continual expansion of the present form of the city in a single global settlement (see *8.4*), Soleri's *Arcology* (1969) advocates the development of a revolutionary new kind of human environment. Within highly integrated and compact urban structures such as the Dam Arcology, Soleri argues a new "neonature" can evolve (see 8.5).

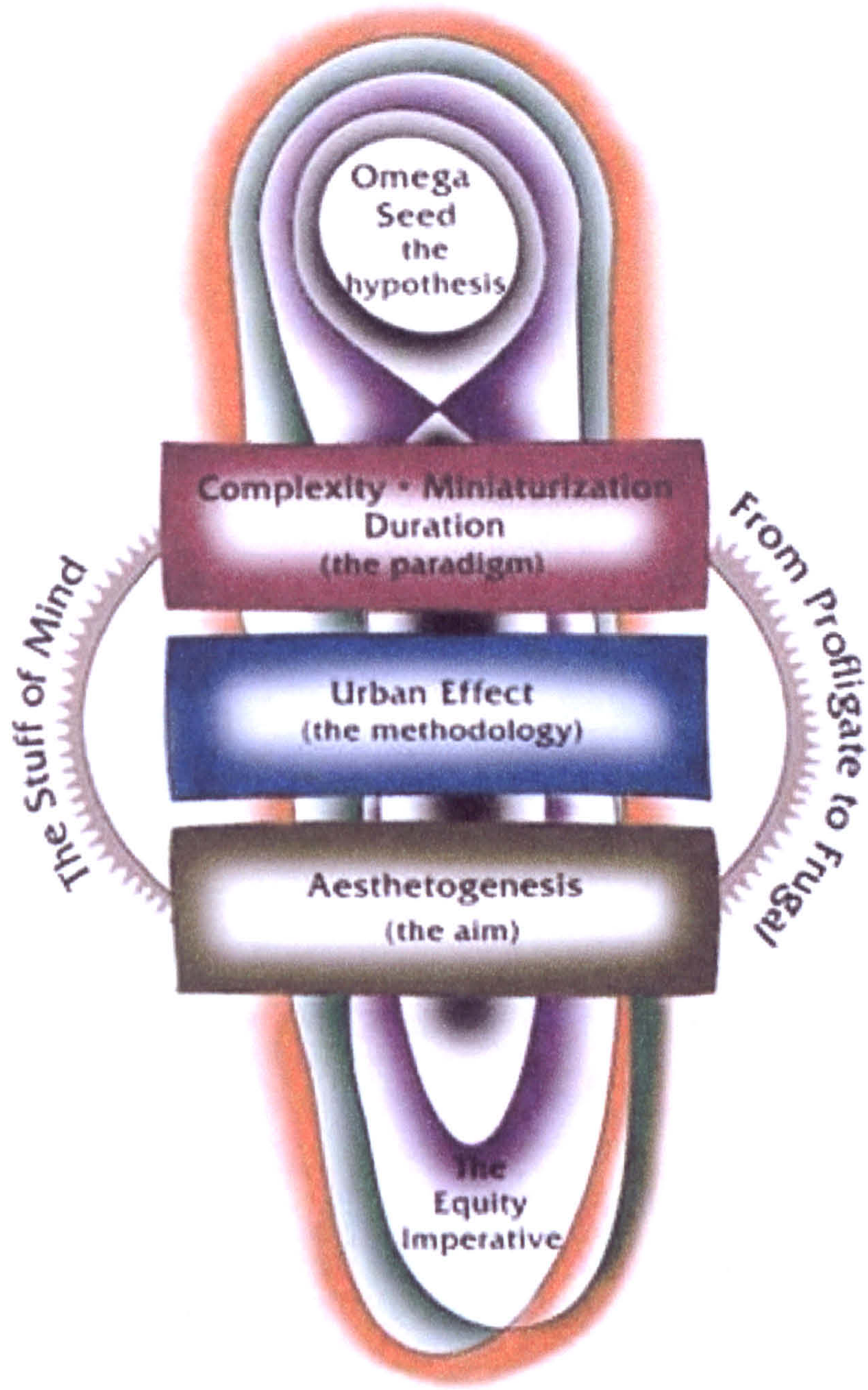


Plate 4 The Arcology Theory

In the arcology theory (see 8.5) Soleri argues that the catalyst of evolutionary creativity should be a city coherent with the *C-M-D paradigm* (see *8.5.1*), one that seeks to maximise the urban effect by raising humanity's collective consciousness. Soleri argues that the city has a role not only in maximising ecological potential but is instrumental in a process that gives meaning to life by helping to transform the human condition (see *8.5.5*).

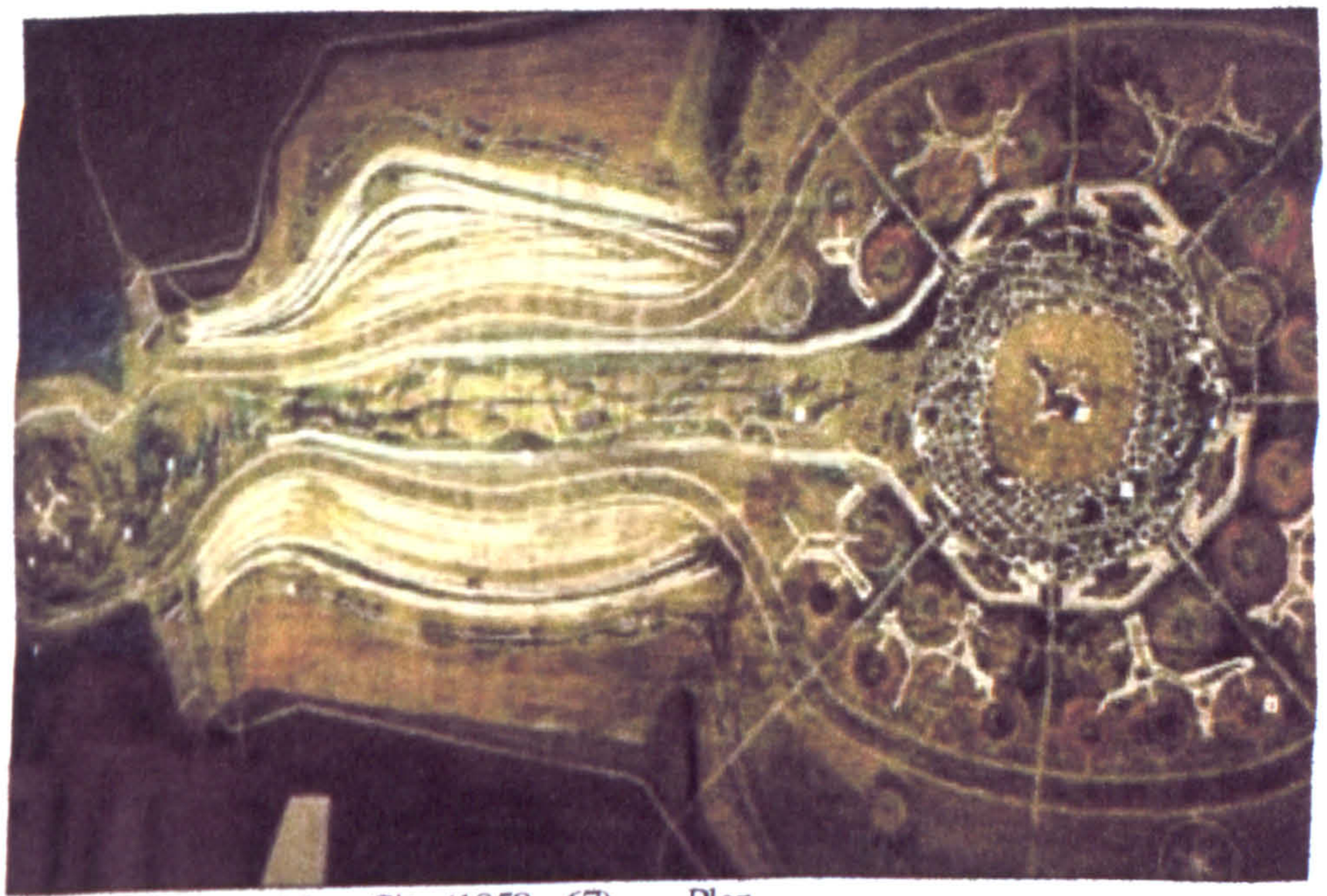


Plate 5 Mesa City (1958 - 67) Plan

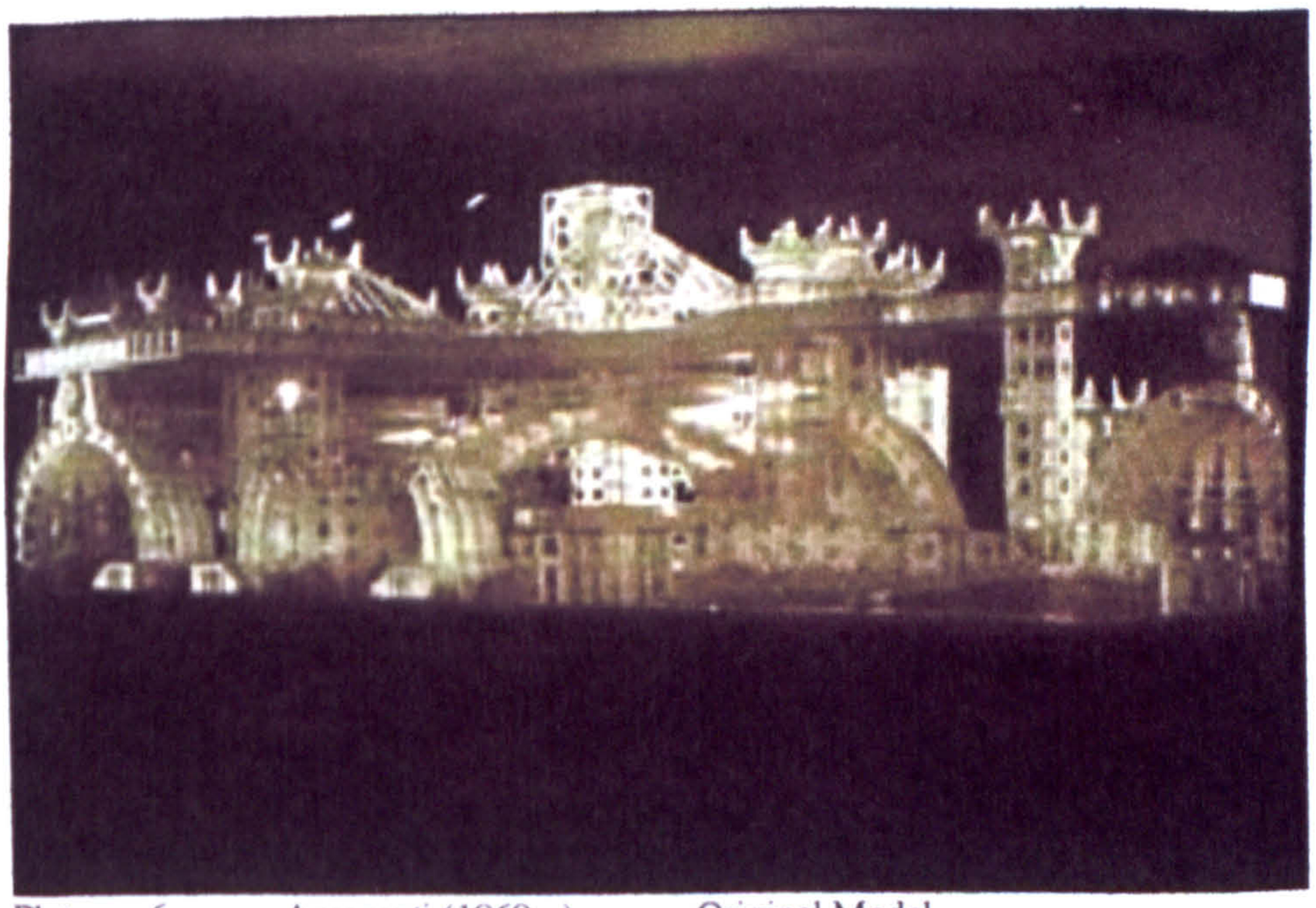


Plate 6 Arcosanti (1969 -) Original Model

The arcology concept has fluctuated between the Dionysian (free form) character of Mesa City (see *8.6.1*) to the Apollonian (simple geometric) character of many of the *first generation arcologies* designed during the 1960s and published in *Arcology: City in the Image of Man* in 1969 (see *8.6.2*). Arcosanti, originally conceived of as a first generation arcology, has gone through various evolutionary stages as the theory has developed (see Plates 20 and 21). Today the arrangement of the various buildings is much more context-driven than the original design proposals suggest (see Plates 24 & 25).

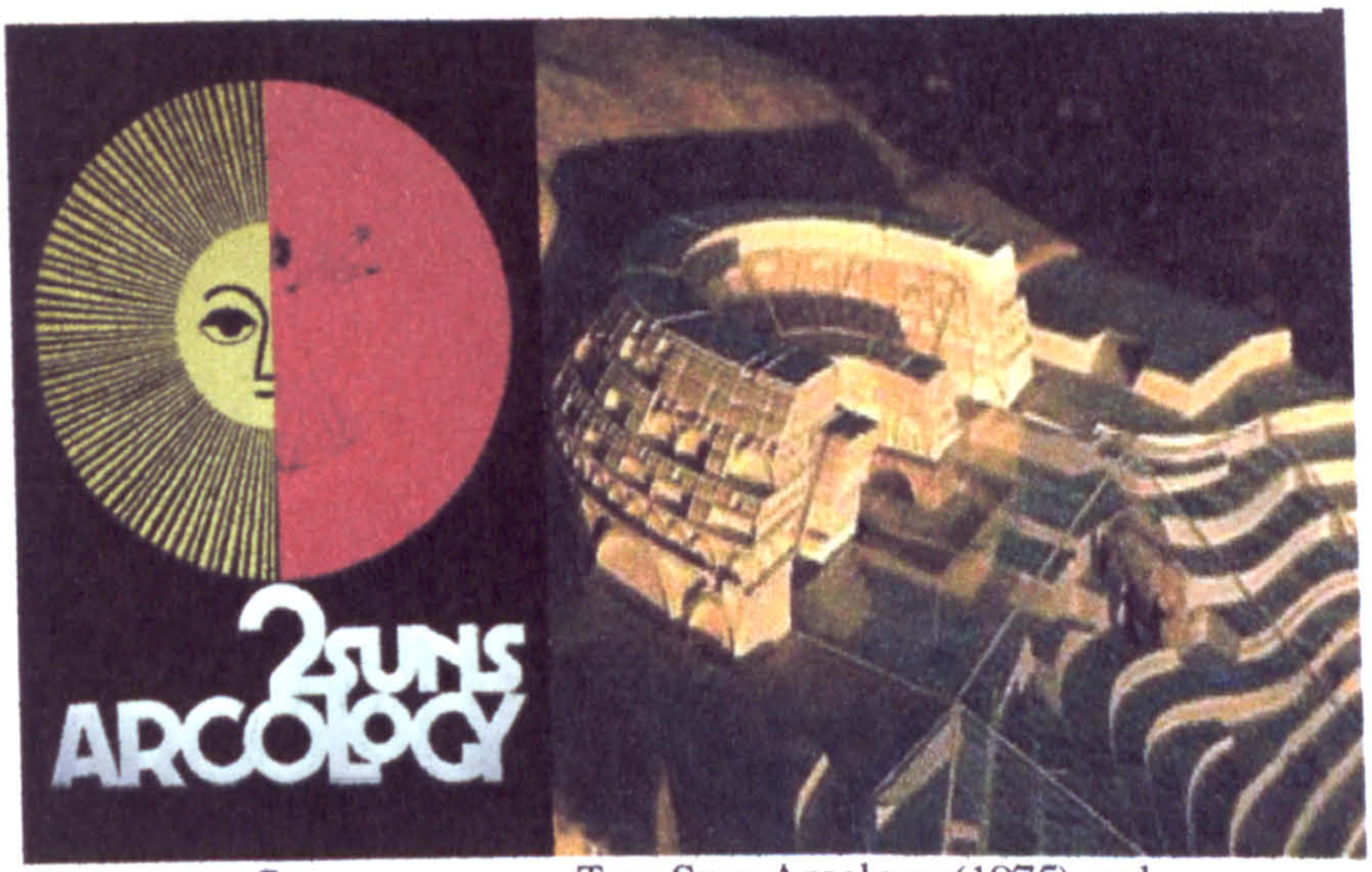


Plate 7 Two Suns Arcology (1975) and the Climate Zone Arcology (1975 - 80)

Plate 8 Air Dam Arcology (1975 - 80)

In the *Two Suns Arcology* (1975), in responding to the growing energy crisis of the mid-70s, Soleri split the architectural concept of the first generation structures in half "exposing the core to the sun" (see *8.6.3*). This produced some highly significant related effects, which were combined in a series of designs, such as the Air Dam Arcology, which gave greater priority to the Sun as the main source of renewable energy. The ideas that emerged within this concept of the "energy city" served to reinforce the relationship between architecture and ecology and placed the arcology model much more firmly into its own ecological context.

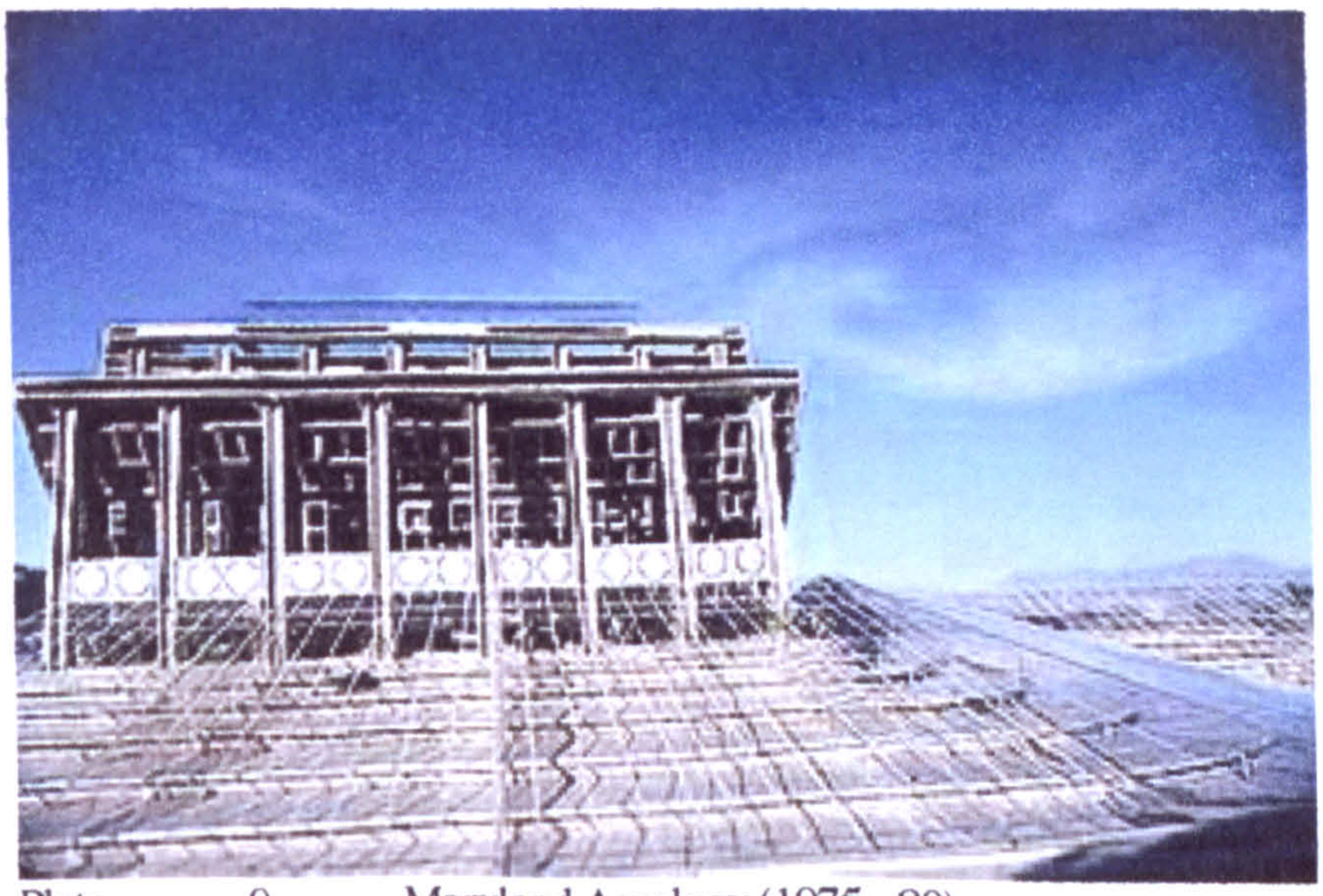


Plate 9 Maryland Arcology (1975 - 80)

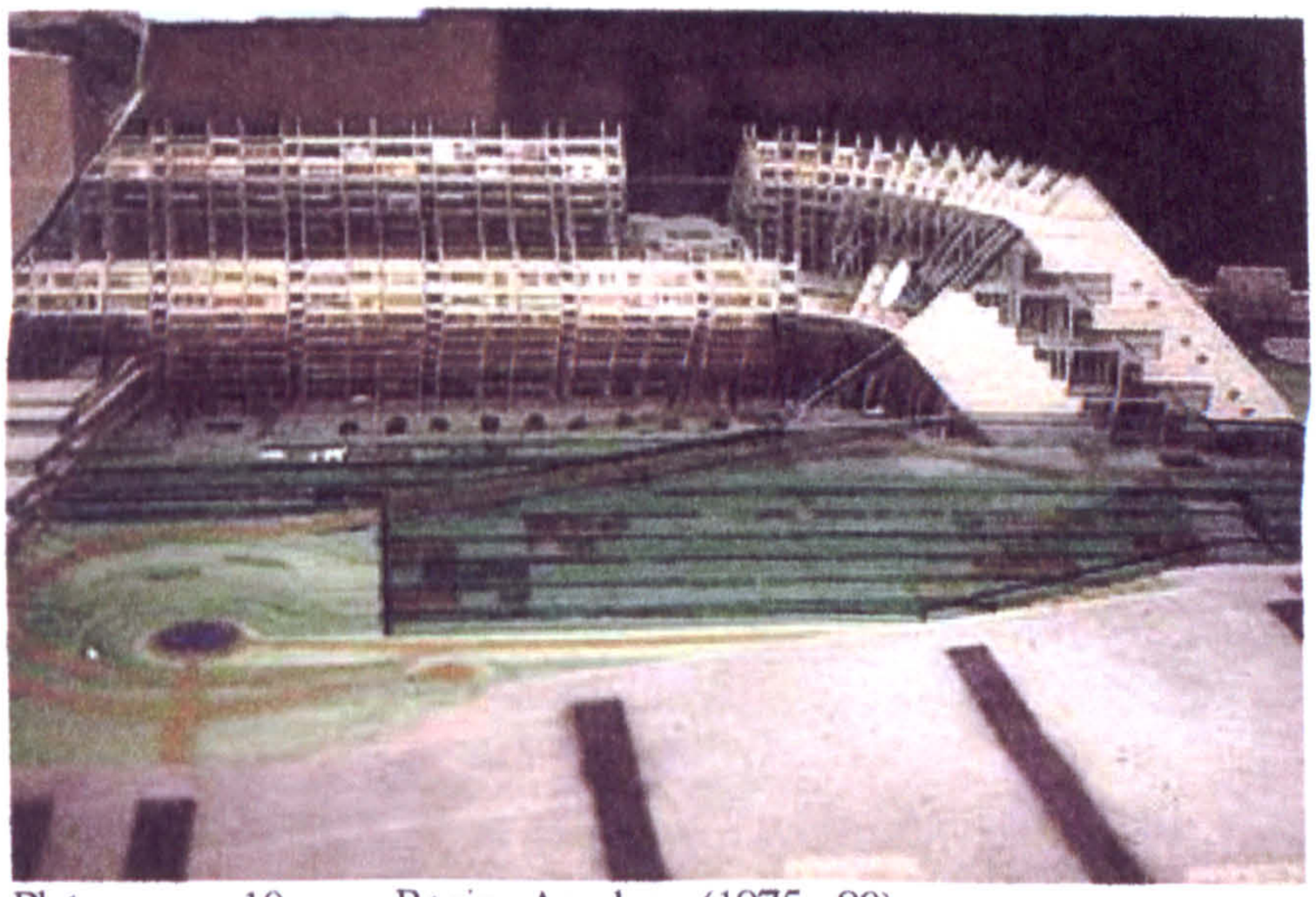


Plate 10 Regina Arcology (1975 - 80)

In *second generation arcologies* the entire form of the urban structure, along with an expanse of south-facing greenhouses that enable large scale food and energy production within an "energy apron" (see 9.5.5), are designed to maximise the use of solar energy while reducing dependence on non-renewable sources of energy. The *greenhouse effect* provides a membrane that helps extend the growing season. The *horticultural effect* involves intensive agriculture and the limited use of water. The *apse effect* provides solar heating and cooling (see Pl. 39) and the *heat sink effect* exploits masonry's capacity to gather, store, and radiate heat. When combined these various architectural effects offer a response to many of today's environmental problems (*8.6.3*).

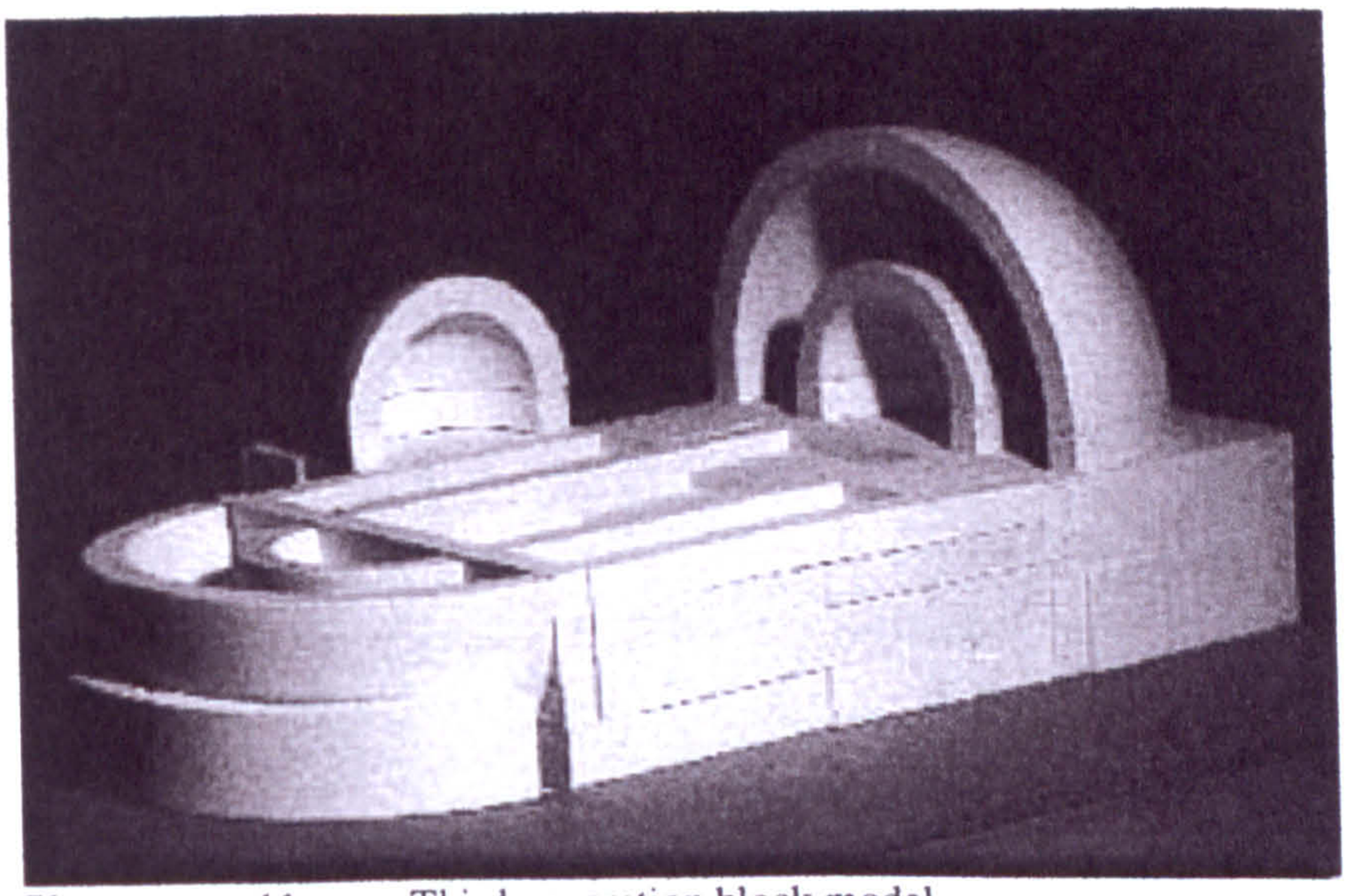


Plate 11 Third generation block model

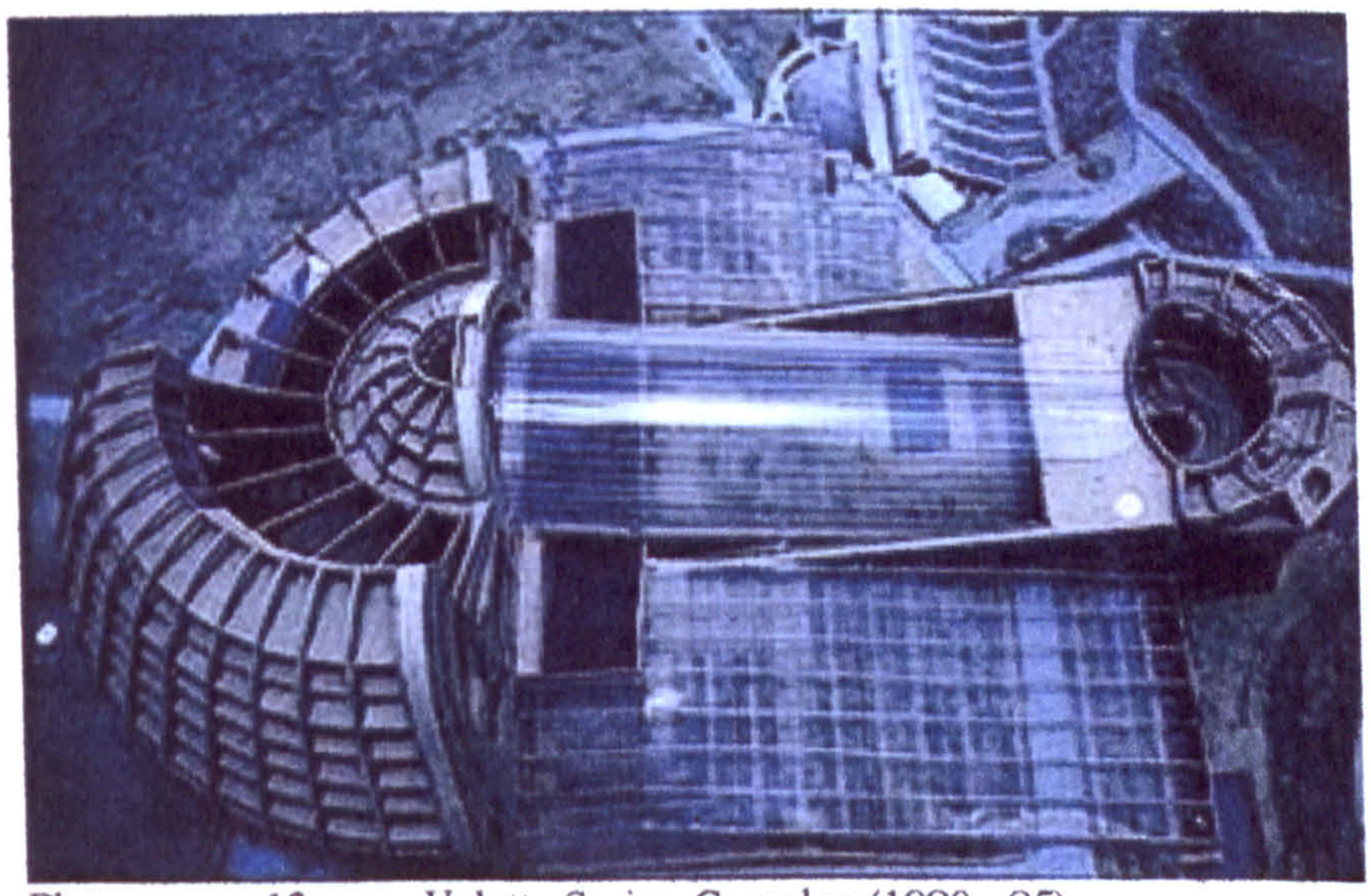


Plate 12 Valetta Spring Complex (1980 - 85)

In *third generation arcologies* the combined effects of the second generation were set within modularised and standardised structures that could be adapted to suit various social and environmental conditions (see *8.6.4*). The apse form became the design generator for what Soleri describes as the "post-slab" habitat. Here the slab is manipulated to envelop space and act as a passive solar device. When orientated toward the sun the structure allows for the retention of heat in the winter and provides shading and cooling in the summer. The shift from the slab (Plates 8, 9 & 10) to the apse form signals a significant shift towards an environmentally responsive and resource efficient design, while providing a strong social and spatial focus for the intended community. The Valetta Spring complex demonstrates the main principles.

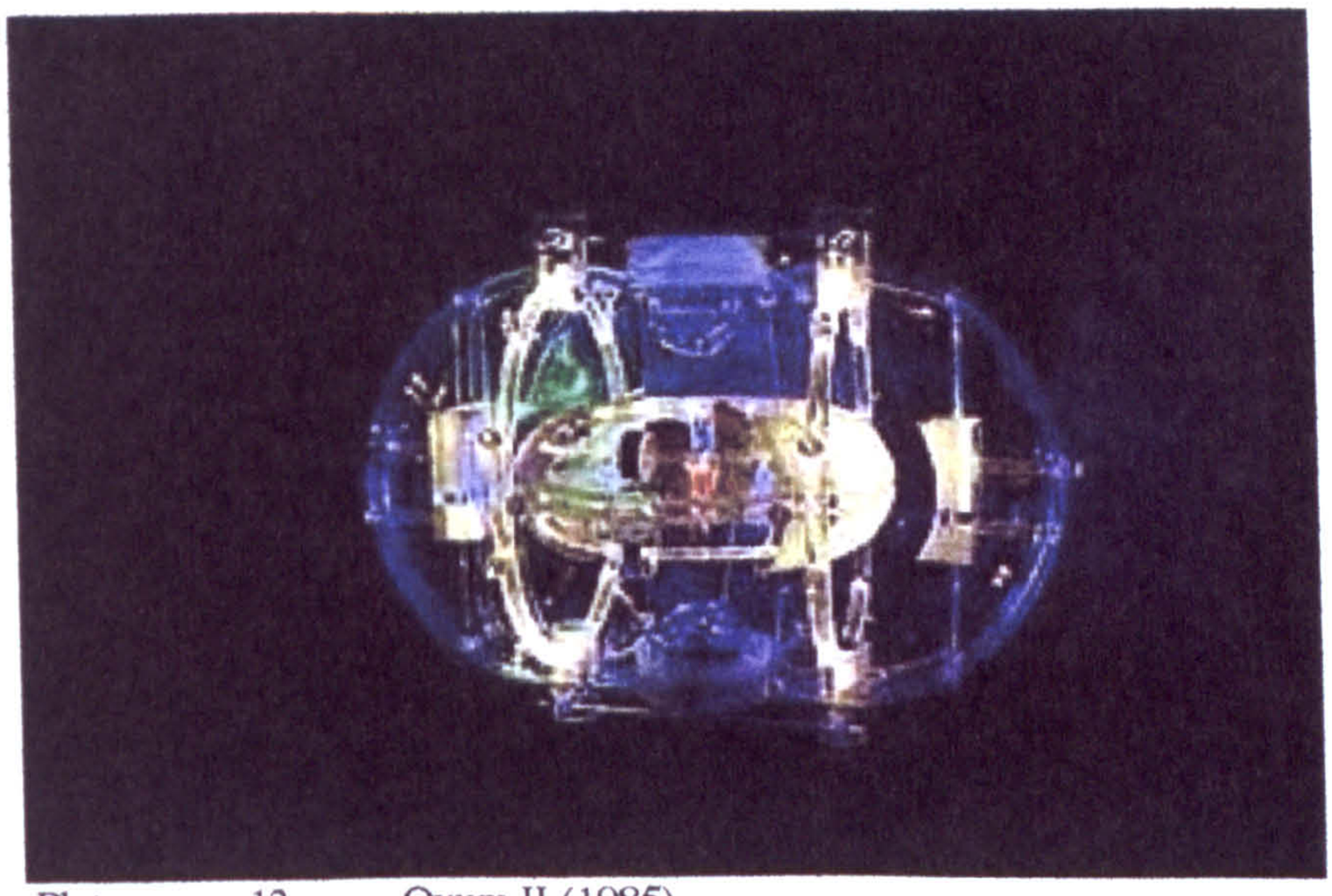


Plate 13 Ovum II (1985)

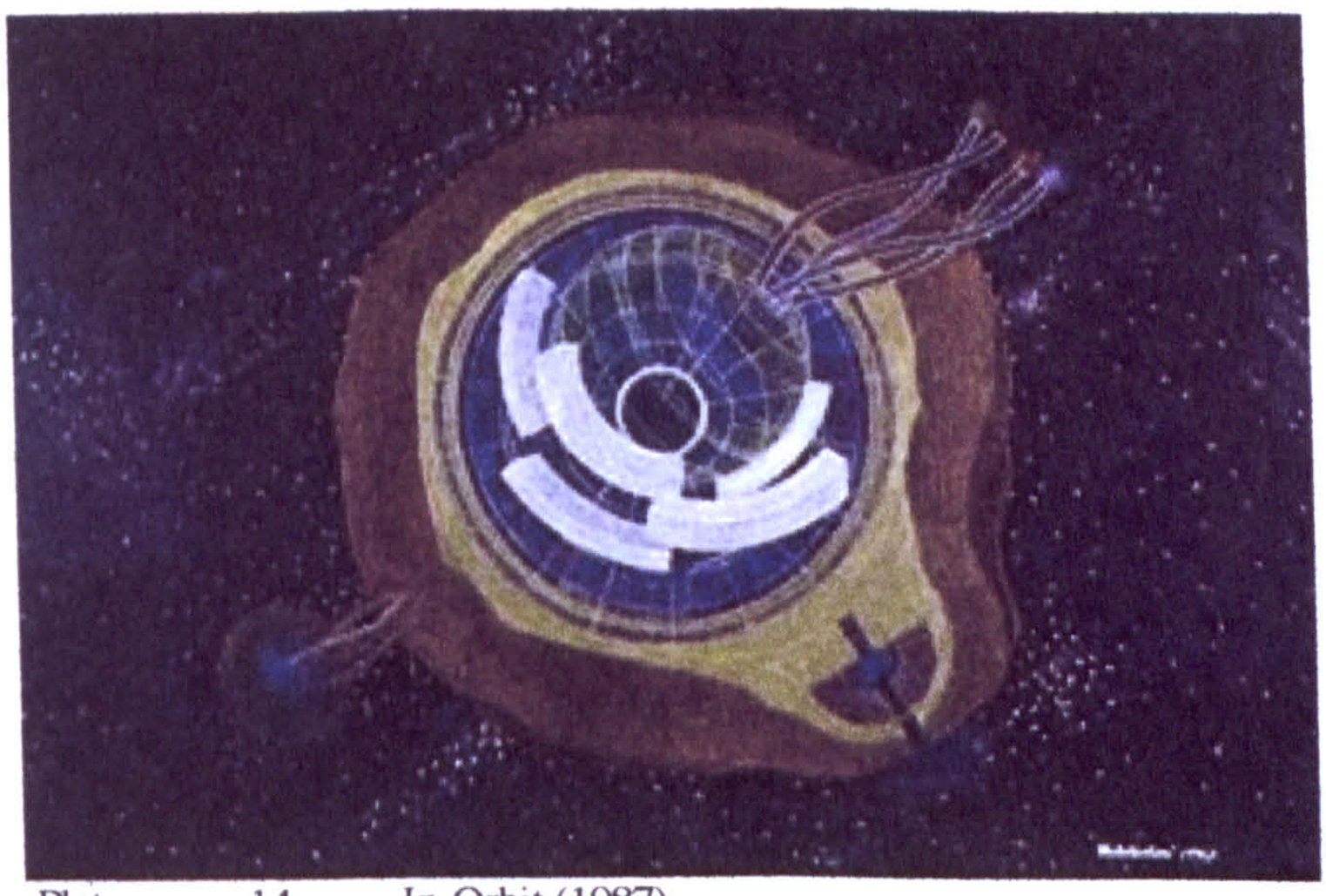


Plate 14 In-Orbit (1987)

The *third generation arcologies* focused on the notion that space will eventually be the locus of new kinds of cities or colonies (see *8.6.5*). The Space Arcologies were designed to illustrate how asteroids could be mined and transformed into small habitats. The proposals were meant to test the conceptual foundations of the arcology theory by exploring ideas of containment, ecological balance, self-reliance and independence within a hostile environment. Ovum II and In-Orbit contain activities in science and research and an urban core with residential and commercial facilities for 5 000 -15 000 thousand inhabitants. The protective bubble encloses a reconfigured landscape inside with a fraction of the earth's gravity and provides a shield to protect the habitat from space dust and radiation.

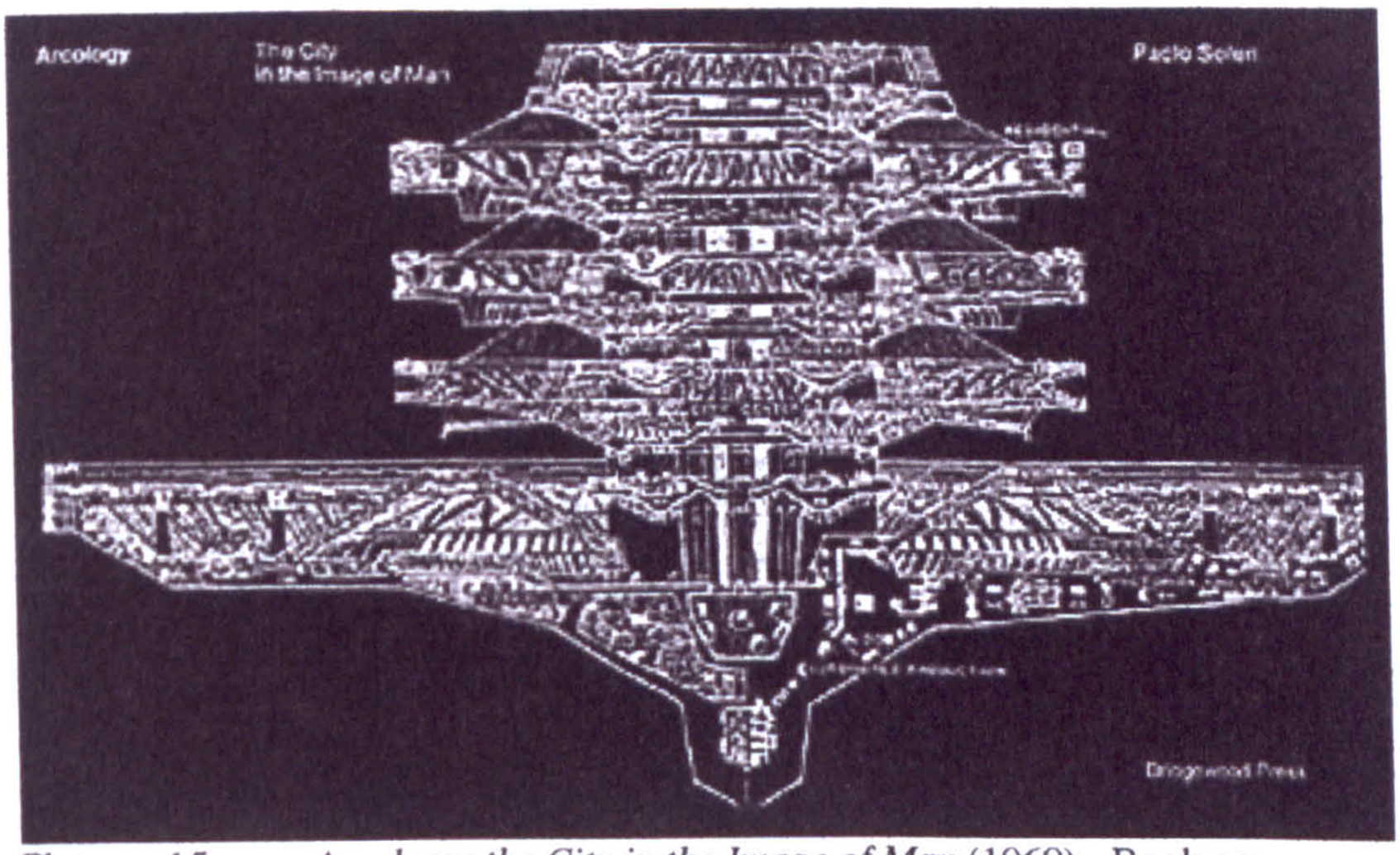


Plate 15 *Arcology: the City in the Image of Man* (1969) - Book cover

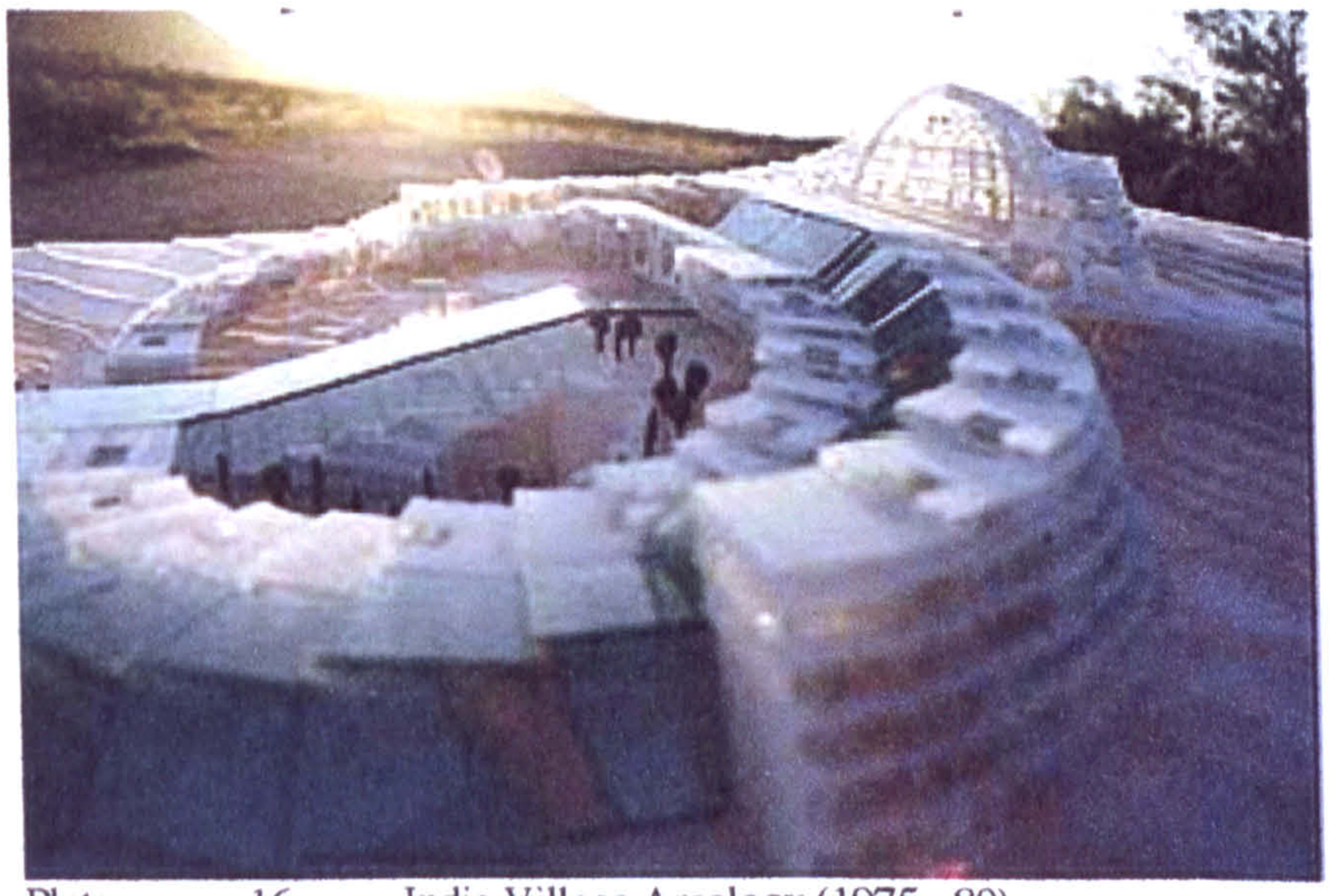


Plate 16 India Village Arcology (1975 - 80)

Arcology is dedicated to the notion of urban containment rather than sprawl. The metaphor of "the City in the Image of Man" emphasises the idea of self-containment. Just as we have a complex system within a body that allows us to interact with the outside world, Soleri argues that the city cannot perform effectively without containment. Ecological sanity, he says, demands intense centres of life that contain and provide for the bulk of the planetary population (see *8.7.1*). Through a higher concentration of land use derived from the sort of mixed-use development advocated in the *India Village Arcology* a settlement's negative impact on the natural environment can be reduced. Arcology offers a fundamental form of mixed use - a variety of uses within a single structure (See *8.7.2*).

Plate 17 Arcosanti Library Greenhouse

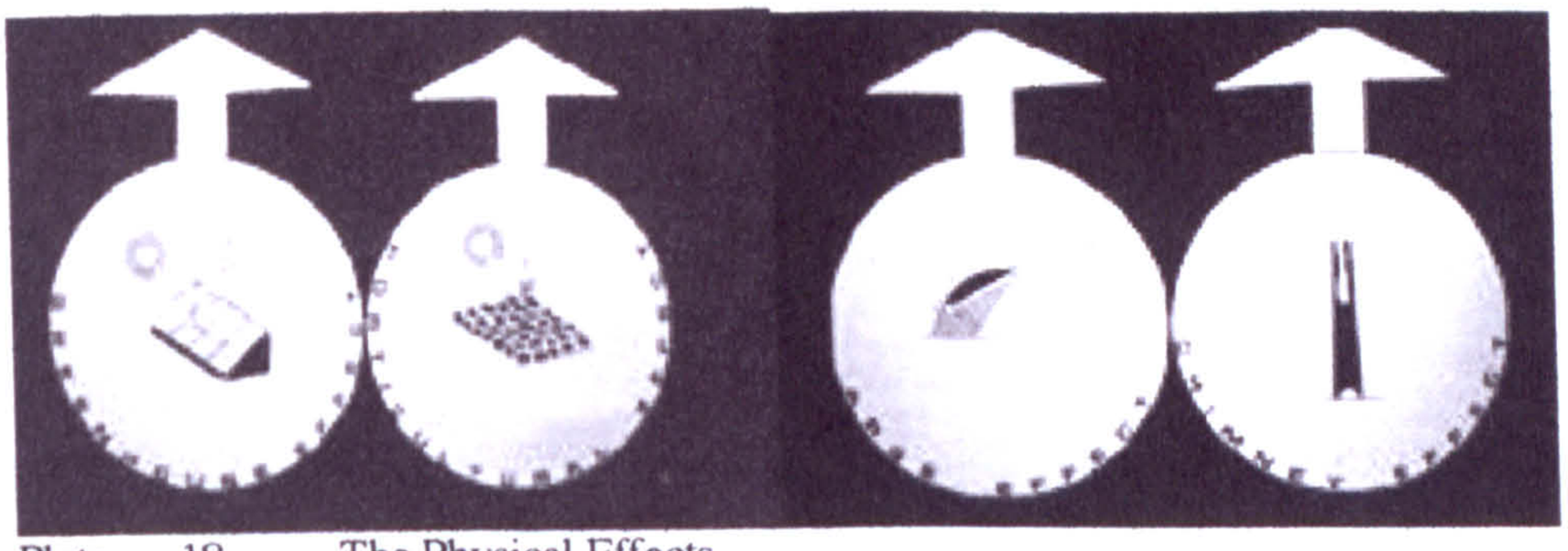


Plate 18 The Physical Effects

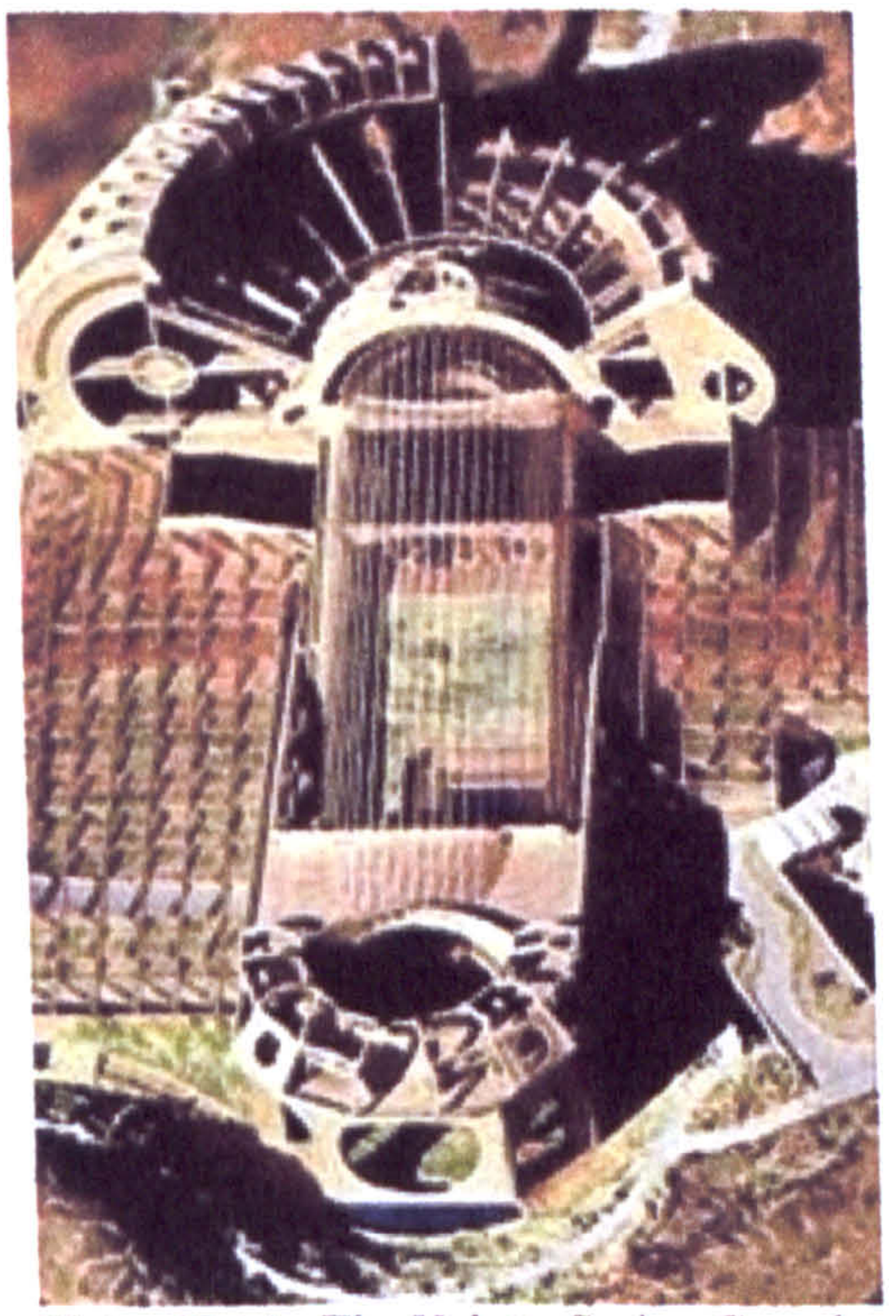
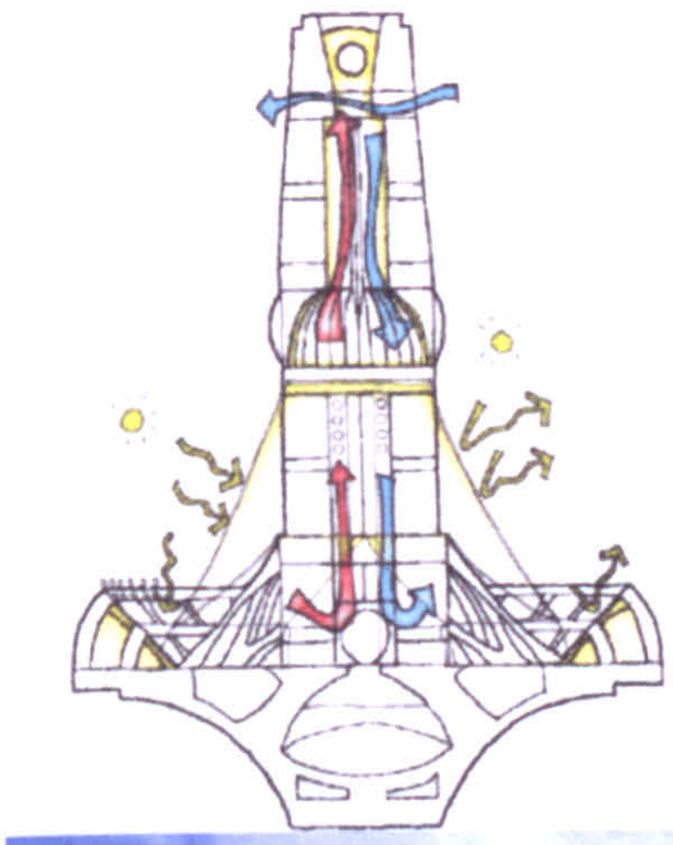
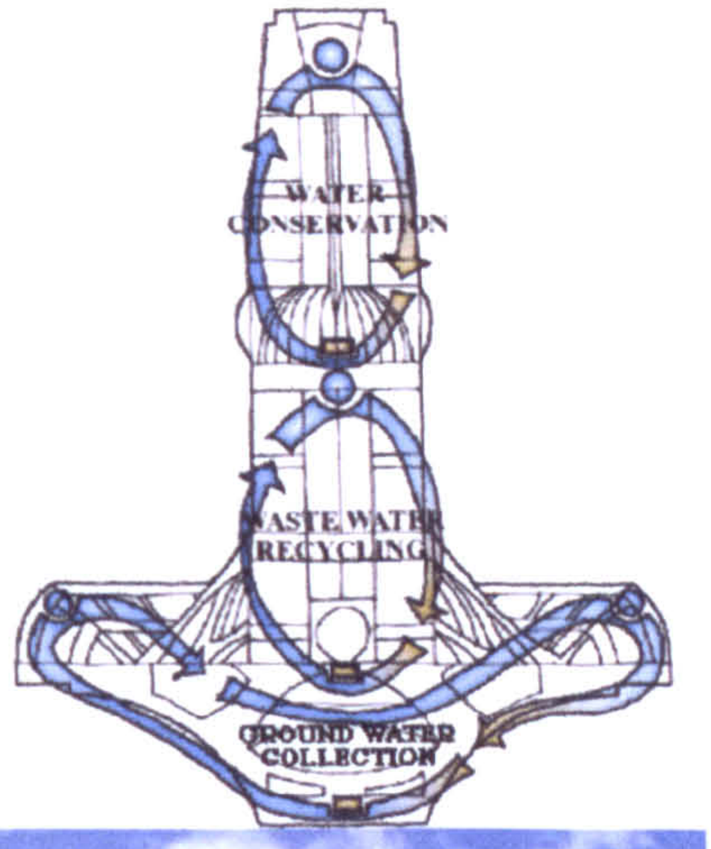


Plate 19 (a) The Valetta Spring Complex

From the *Two Suns* approach the arcology theory conceives the city as a complex in which living, working, learning, and playing are integrated with food and energy production (see *8.7.4*). The aim is that through a blend of energy and land use efficiencies, and recycling systems, the ecological integrity of the region remains intact since fewer demands are put on land, water and soil, and fewer resources are needed to maintain the "energy city" (see *8.7.5*).





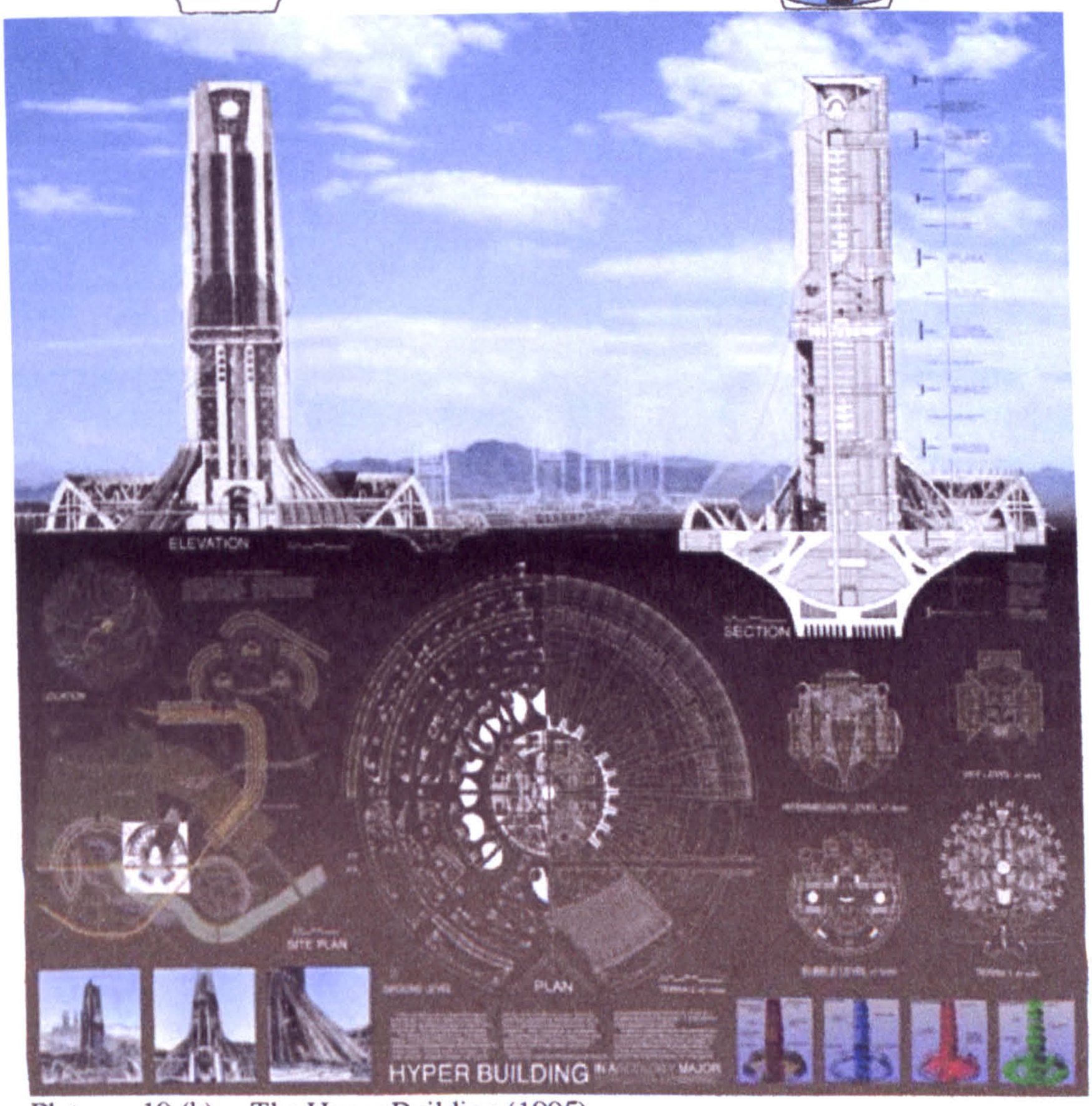


Plate 19 (b) The Hyper Building (1995)

Many of the physical effects and environmental benefits described under the aegis of the *urban effect* have been drawn together in designs for the *Hyper Building*, a 1000 metre-high tower surrounded by a 500 metre-wide multi-level concentric *exedra* (see 9.6.2). Containing a large spectrum of urban activities, the designs, commissioned by the Japanese government, provide for a permanent population of 10 000 and a commuting population of 140 000 (See 8.8)

Plate 20 Arcosanti Model (1980 - 85) Plan view

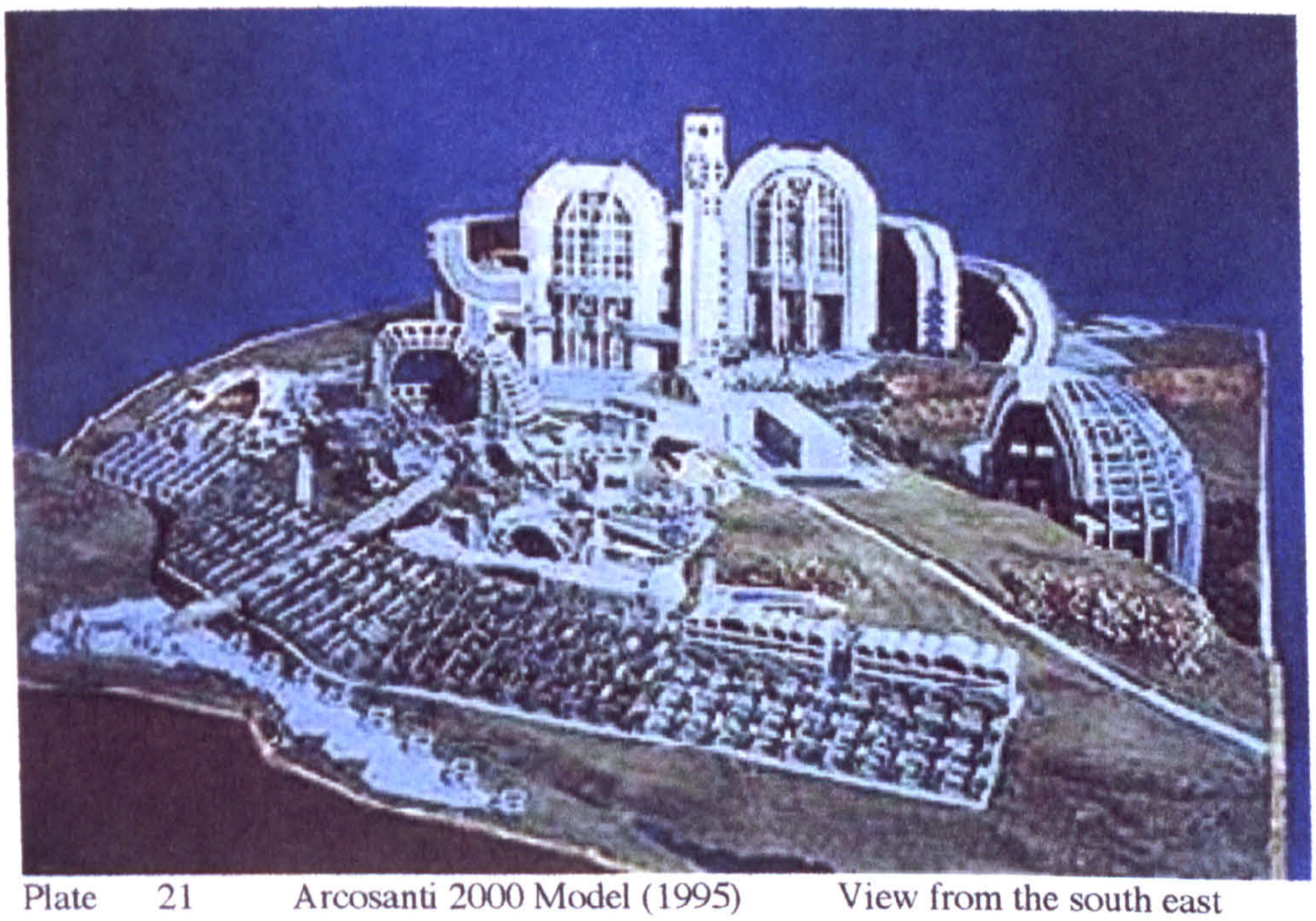


Plate 21 Arcosanti 2000 Model (1995) View from the south east

When complete it is intended that Arcosanti will house a community of five to six thousand people occupying 15 acres of an 860-acre land preserve. The buildings which face the Sun to gather its energy, will stretch no more than a quarter of a mile on any side but will rise to 30 storeys (see 9.1). An integral part of the project will be up to 7 acres of south-facing greenhouses described as an "energy apron" which will act as a key system for producing food and collecting energy to support the town (see 9.5.5).

Plate 22 Cosanti (1956 -) Aerial view

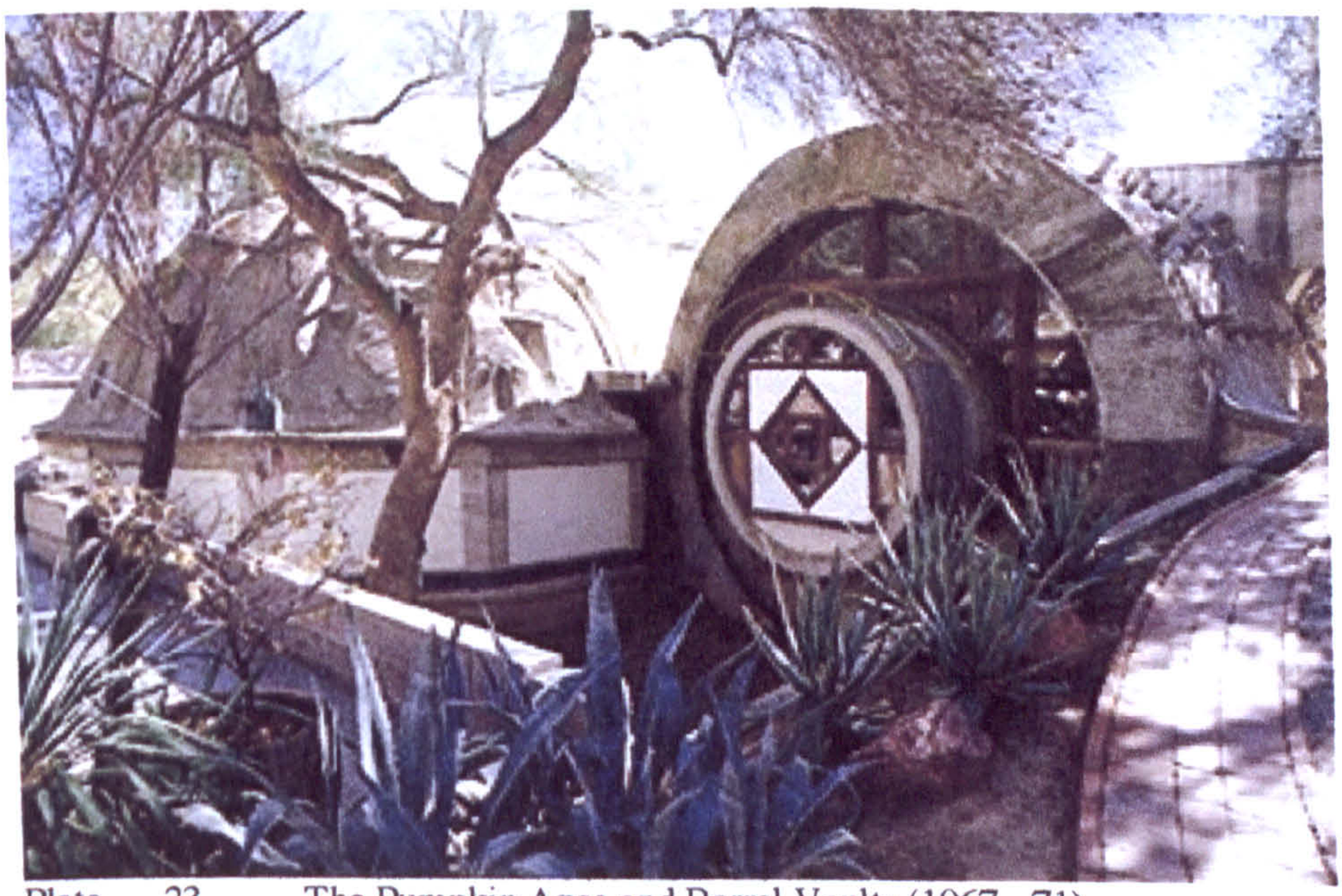


Plate 23 The Pumpkin Apse and Barrel Vaults (1967 - 71)

In 1956 the Cosanti Foundation was established to pursue the research and development of an alternative urban environment. *Over the next* two decades a complex of silt-cast structures and buildings including housing, craft studios, a foundry, workspaces and living areas, was constructed on 5 acres of land (see 9.3). The casting technique derived from an ancient craft, uses river silt as a moulding material that allows concrete to be shaped in a variety of forms. Patterns can be carved into the silt and colour pigments added, which are absorbed into the concrete during the curing process (see Plate 27).

Plate 24 Arcosanti (1990s) View from the opposite mesa

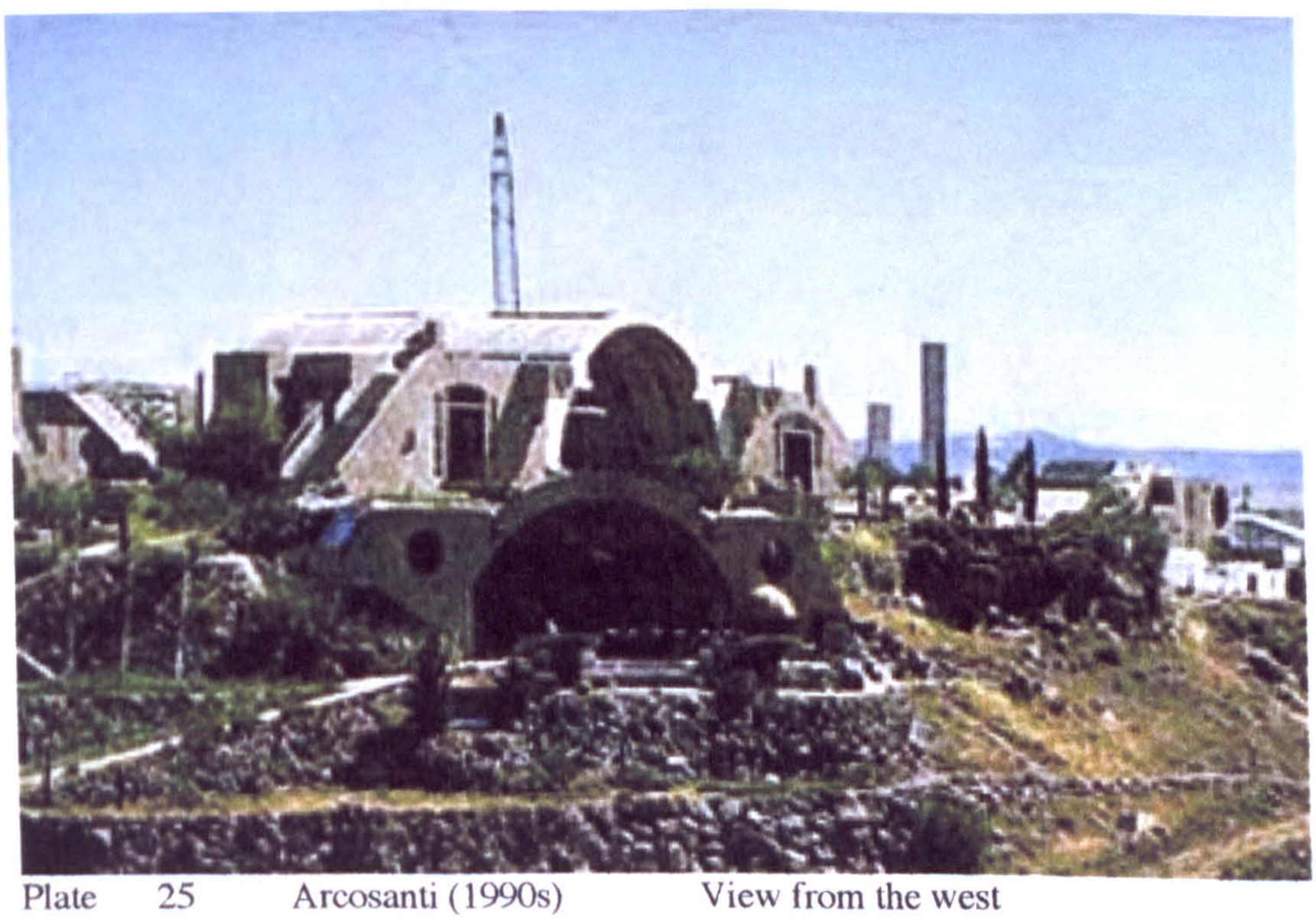


Plate 25 Arcosanti (1990s) View from the west

Arcosanti is listed on the official Arizona State map as a small town. It is a cluster of structures and spaces positioned on a south-facing mesa in a semi-arid desert region. The curved form predominates throughout. Many of the structures, designed to take around six thousand people define sheltered-but open-spaces that accommodate the social and work places for the 60 who now live there. The lack of resources means that Arcosanti is physically languishing, even although there has been a resurgence of interest in the project via the Internet and the Paradox Project (see 9.7)

Plate 26 Main Vaults (1971 - 75) View from the south

Plate 27 Silt cast designs on the Vault interiors

The south section of the *Main Vaults* was the first structure to be completed in Arcosanti in 1971 (see *9.4.1*). The Vaults are intended to form the entrance to the completed Arcosanti 2000 project, positioned between the public space of the *double exedra* and the *energy apron* (see Plates 21 & 40). Currently they are used for social gatherings and morning meetings, held to discuss the daily work programme. The interior has been decorated using paint pigments set into the silt. These are absorbed by the concrete as it cures.

Plate 28 The Ceramics Apse (1972 - 73)

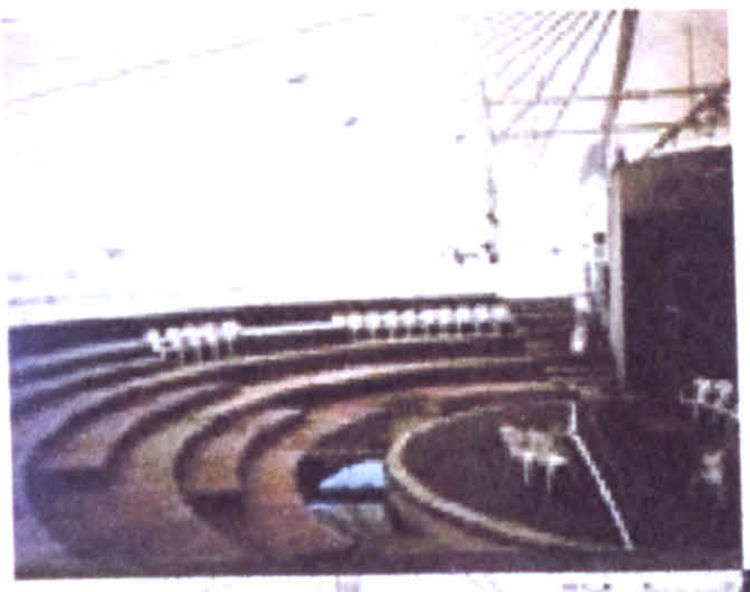
Plate 29 The Foundry Apse (1972 - 74)

The Apses shelter and shade the main working spaces at Arcosanti. It is here that the wind bells, that fund the project's ongoing construction, are fired and cast. Both apses have a 7 m radius and act as passive solar "machines" - shading provides a cooler working area in the summer and warmer spaces in the winter (see *9.4.2*). Tensile cables allow opaque membranes to be opened and closed to provide a degree of environmental control. The channels at the front of the Foundry Apse (Plate 29) direct rainwater into cisterns below. The cisterns will be used later to irrigate the cultivated crops in the greenhouses (see *9.4.3*).

Plate 30 East Housing (1972)

Plate 31 The Crafts III Building (1973 - 77)

East and West Housing provide shared living accommodation. Both units are entered via a sun-space to the south. Large windows, hung like doors, are closed in winter allowing for the passive radiation of heat into the common spaces. In the summer the windows are left open to ventilate the house (see *9.4.4*) The same technique is adopted in the *Crafts III Building*, which also provides Soleri's most complete example to date of a mixed use, multi-storey structure, containing residential, commercial and recreation activities. The building aims at demonstrating the arcology model's key principles of complexity and three-dimensionality (see *9.4.5*).



The amphitheatre space behind the Colly Soleri Music Centre provides a 500-seat venue for events such as the Minds for History Conference (1989) (See *9.5.6*) and the Paradox Conference (1997) (9.7). Eventually the garment architecture will be supported on the piers of the surrounding housing units.

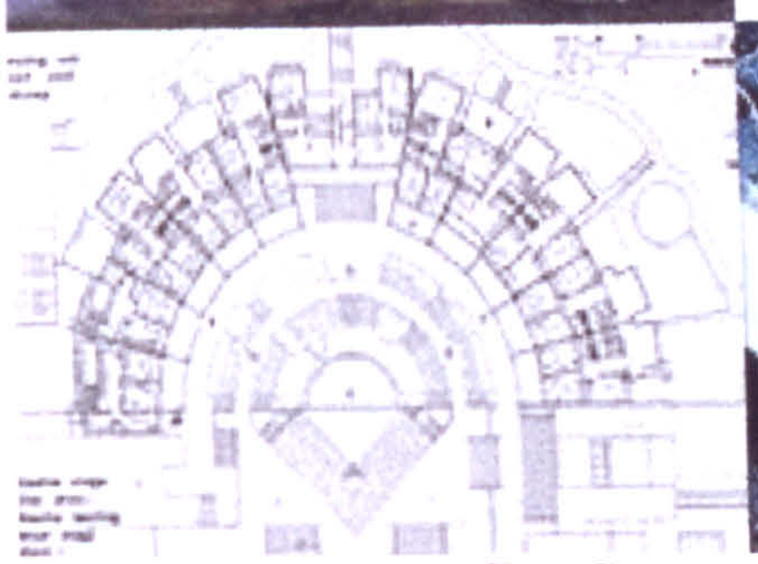


Plate 32 East Crescent Plan, model and amphitheatre

Plate 33 East Crescent Housing (1975 -)
Units 1 and 2

East Crescent Housing, when complete will provide living/working accommodation for around sixty inhabitants. The units are designed to heating provided by the *energy apron* (*9.5.5*) and hot water supplied by a solar system. A heat tunnel wraps around the rear of the crescent with openings under the floor into each of the residential units. Warm air is drawn up into the units, warming the structure, which radiates heat during the cool evenings. Half of the crescent is now complete.

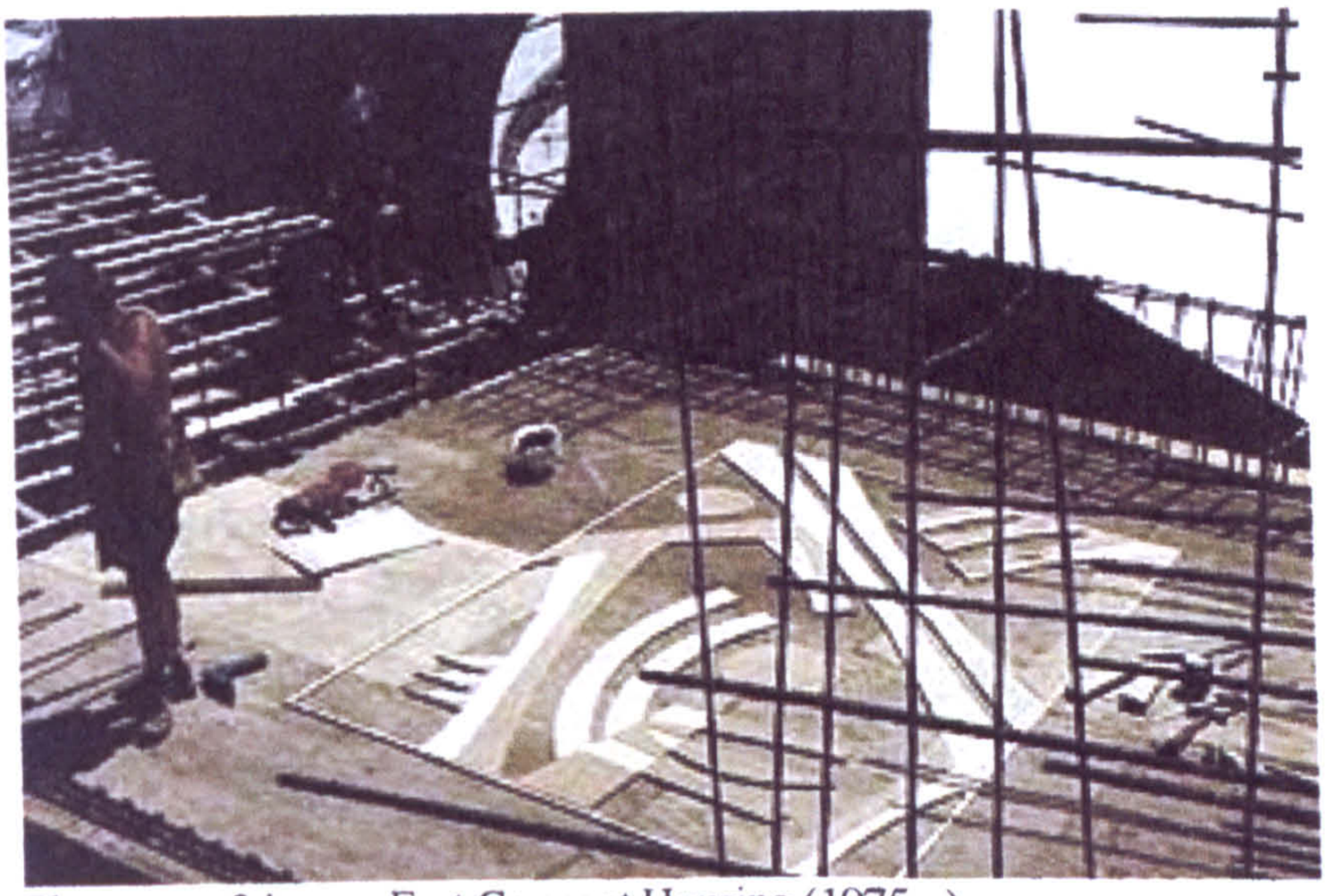


Plate 34 East Crescent Housing (1975 -)
Silt cast panel for unit 3

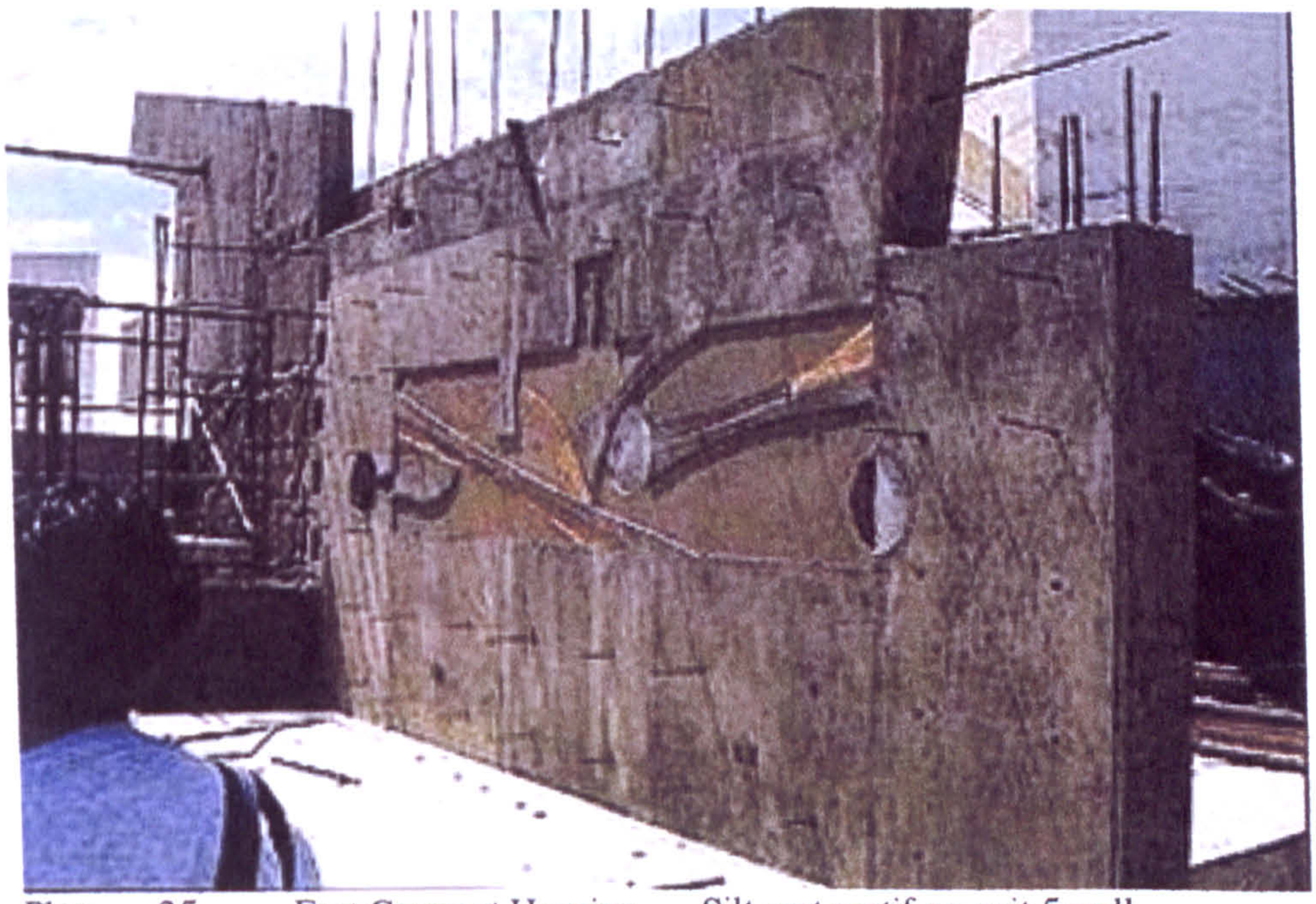


Plate 35 East Crescent Housing Silt cast motif on unit 5 wall

Arcosanti is intended to be an *urban laboratory* for the purpose of investigating the process of designing, building and operating a functioning prototype arcology. It aims to explore ways in which the city infrastructure might contract and become more intense, in order to become more efficient, ecological and sustainable. The laboratory is the place where, through the trials and errors of lived experience, the basic tenets of the theory are being tested. Failure is seen as an integral part of this process (see 9.5).

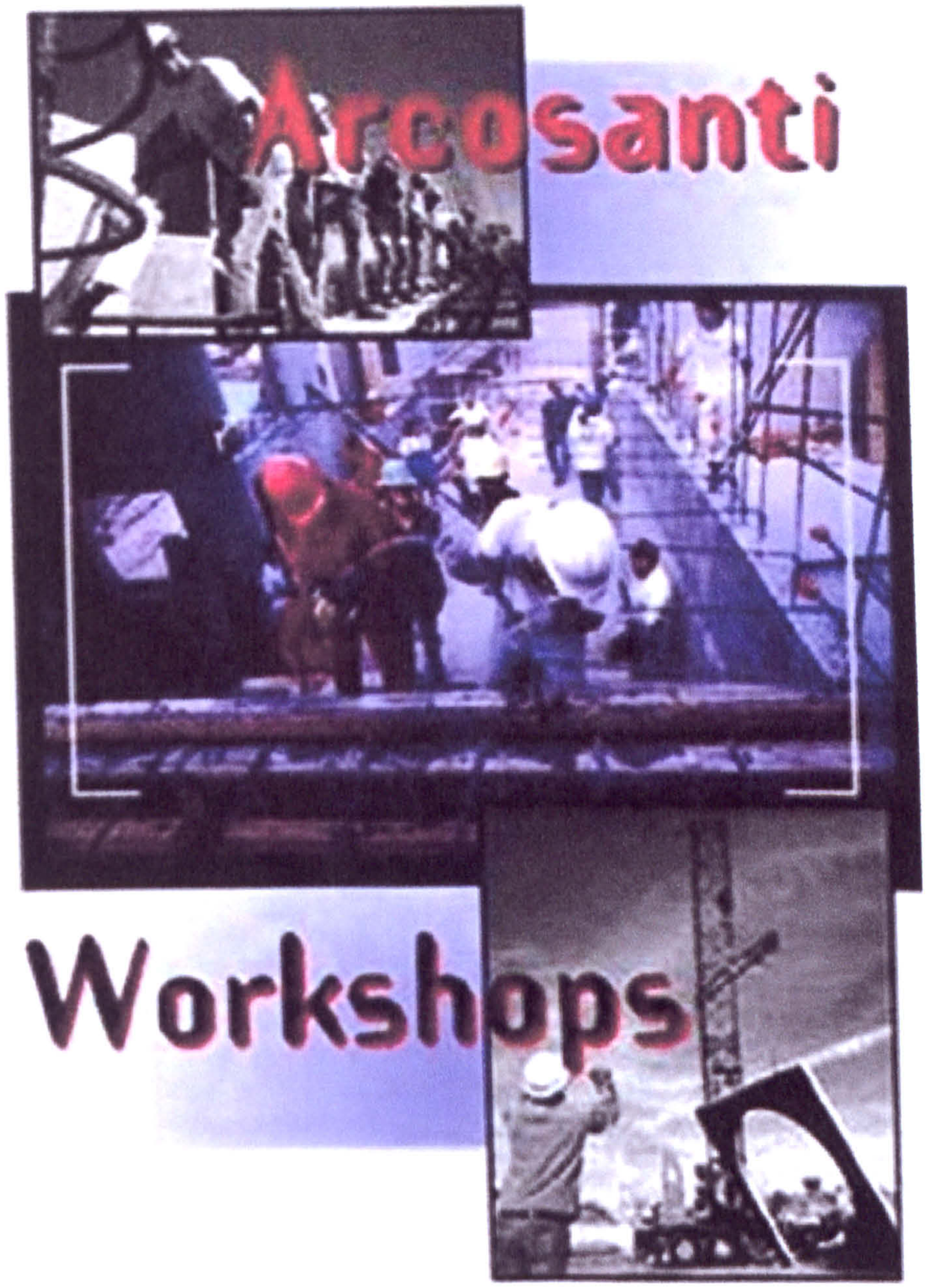


Plate 36 Construction workshop poster

Construction workshops at Arcosanti offer participants the opportunity to "learn by doing". During a five or six week stay they are involved in a range of activities, involving theoretical discussions on arcology, lectures on ecology, sustainability, building construction, and participate in the ongoing construction programme. They are also involved in aspects of site maintenance and recycling duties. Participants sleep in 8ft by 8ft by 8ft concrete 'cubes' in the 'camp' down by the Agua Fria River. Completion of the workshop entitles individuals to be considered for longer periods of residency and employment (see 9.5.2).

FIGURE 1. MONTHLY MEAN TEMPERATURES INSIDE (——) AND OUTSIDE (- - - - -) THE GREENHOUSE

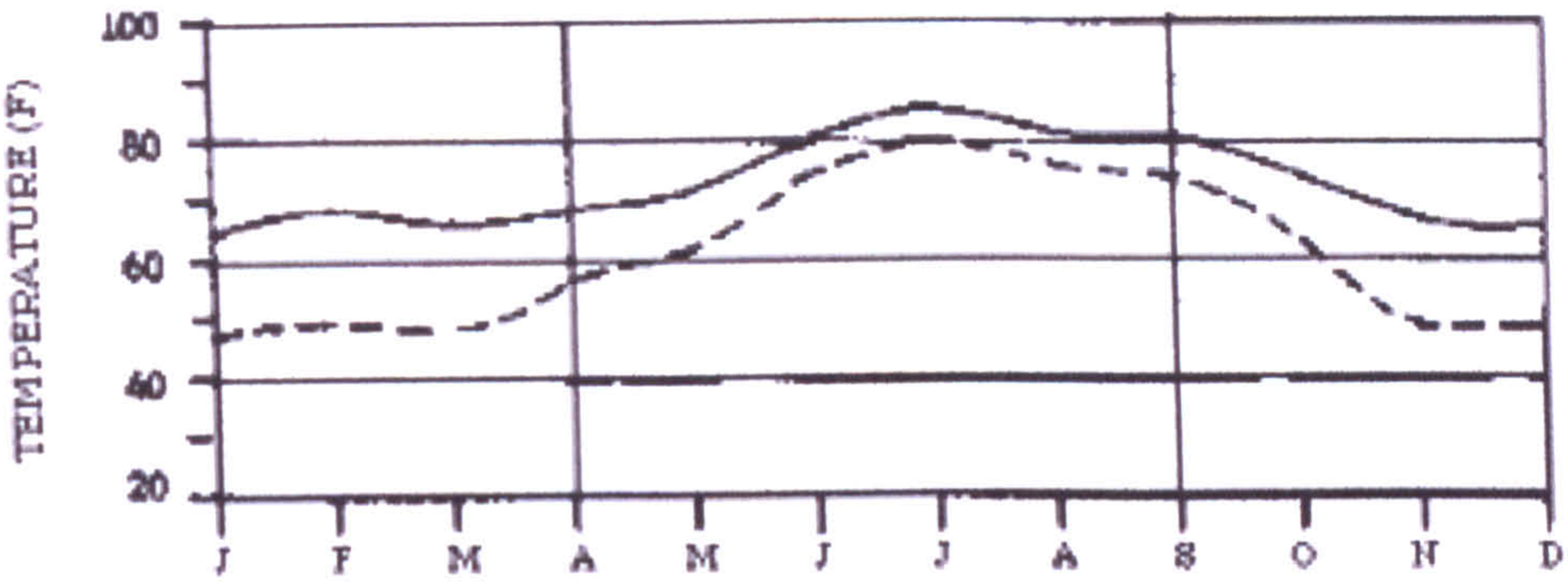


Plate 37 Temperature differentials due to the greenhouse effect

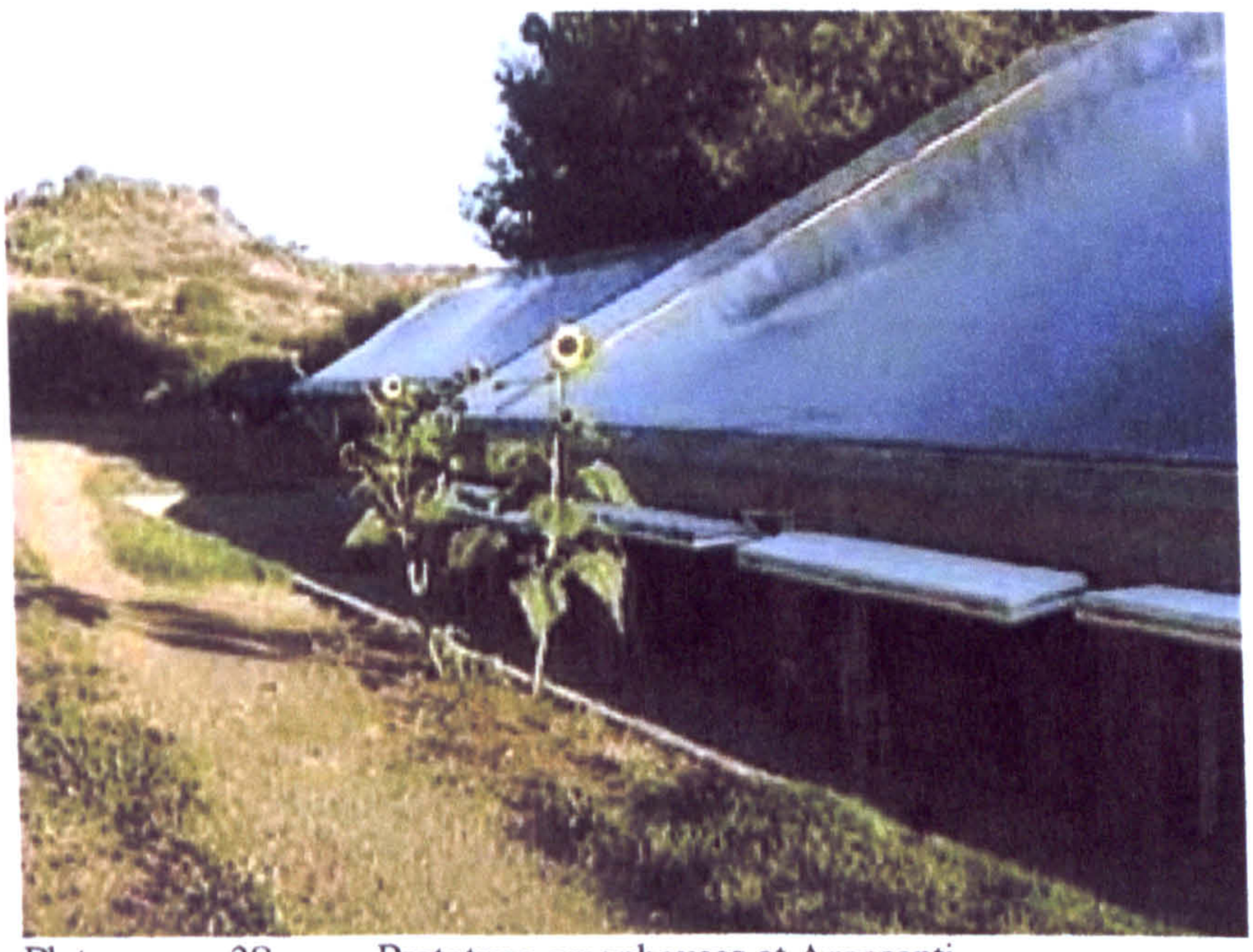


Plate 38 Prototype greenhouses at Arcosanti

Arcosanti organics maintains two prototype greenhouses at the site. These are part of a sustainable food production system which aims at providing the Arcosanti project with fresh produce and a greater degree of future self-reliance at a basic level of food production (see *9.5.4*). The greenhouses are designed to benefit from:-

- *heat collection* - curved retaining walls provide the heat sink effect;
- *greenhouse shading* - deciduous plants during hot summer months, while winter leaf drop ensures maximum seasonal sun penetration;
- *membrane system* - the use of a tensioned polythene membrane is being explored for both economic and aesthetic reasons. (see *9.5.5*)

The greenhouses can extend the growing season to a full year.

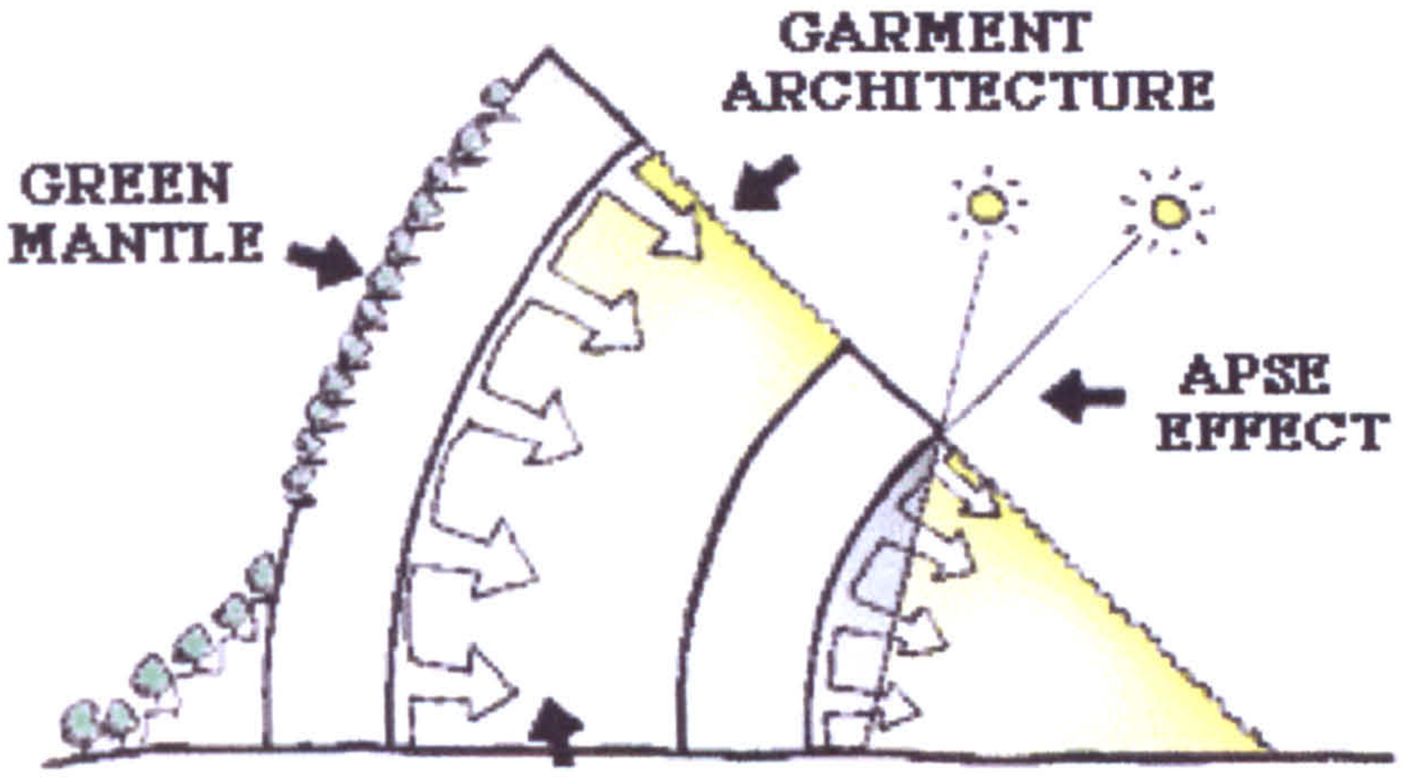


Plate 39 The Exedra Effects

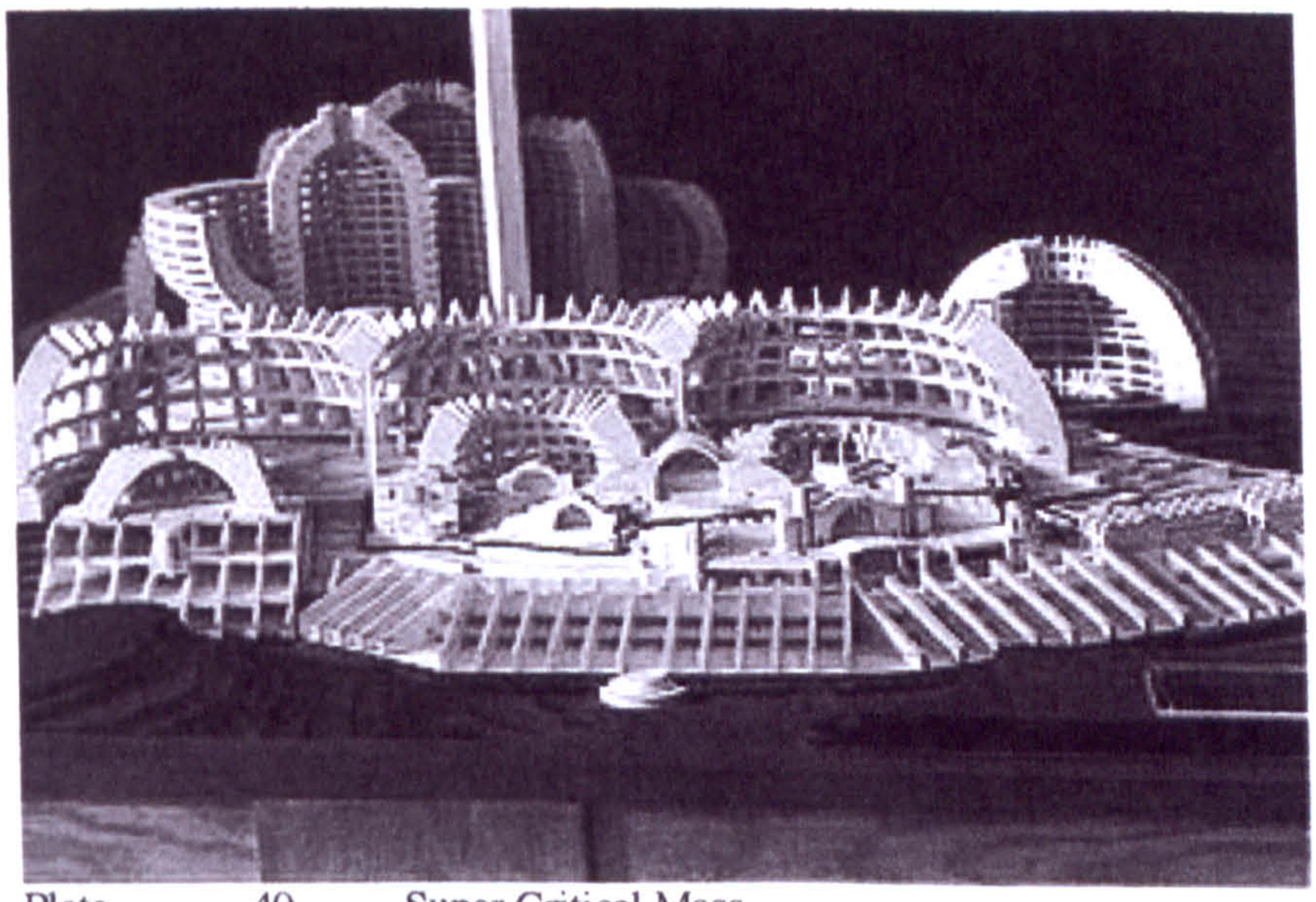


Plate 40 Super Critical Mass

Arcosanti 2000 is the most current design proposal for the completed project (see Plate 21 and 9.6) showing a series of large-scale structures along the Agua Fria Canyon Rim, north of the existing site. A step towards the larger scheme was described in 1995 as *Super Critical Mass* (Plate 40). This involves proposals for 1 500 people to be accommodated within three *double exedra* structures which embrace and partly enclose the existing south-facing buildings on the site. The *exedra*, a development of the apse form, contain residential, office, retail and commercial space and exploit a *green mantle* and *garment architecture* as part of the sustainable design strategy (Plate 39). (see *9.6.2/3&4*)

Plate 41 The Paradox Project

Plate 42 The Teilhard de Chardin Complex

The Teilhard de Chardin Complex is designed as a non-denominational religious centre to be used as a centre for research and education in theological studies (see *9.6.5*). More recently it has been proposed as the location for the Paradox Project. This recent initiative aims to explore the fundamental relationship between the arcology model and the issues raised by the proliferation of the Internet. It is hoped that members of the cyberspace community will support new funding initiatives for Arcosanti (see 9.7).

Plate 43 Morning Meeting in the Vaults

Plate 44 The Daily Concrete Pour

This morning at a meeting held around dawn in front of the project's *Main Vaults* a small group of people will have been discussing the daily work programme. For them Arcosanti represents unfinished business. Others can decide whether the project is experimental or utopian, "a science fiction fantasy, an Orwellian nightmare, or a new evolutionary stage in the progress of the human spirit". For them it is straightforward. It is simply a question of how much concrete they can manage to pour today.

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