

(Source: C.A. Doxiadis, *Action for Human Settlements* (Athens, Athens Center of Ekistics, 1976), pp. 151, 153, 155 and 157).

Doxiadis and the ideal dynapolis: The limitations of planned axial urban growth

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Introduction

From the mid-1950s till the mid-1970s, Constantinos A. Doxiadis (1913-1975) was probably the world's leading analyst, designer and promoter of urban development. His firm, Doxiadis Associates, was one of the most active urban development and planning consultants, operating in over 40 countries, and it designed some of the world's largest national housing programs, new city, urban expansion and urban renewal projects. Doxiadis established and promoted ekistics as a new field of study, "the science of human settlements," he co-founded its journal *Ekistics*, and he authored or co-authored over two dozen books and literally hundreds of articles and planning reports. Between 1963 and 1974 he also organized nine international conferences known as the Delos Symposia, involving many of the most creative intellectuals of the era, and he participated in several other major conferences on urbanism and global futures.²

From the end of the Second World War in 1945 till his untimely death in 1975, Doxiadis conceived and promoted ekistics as a single, integrated, pure and applied discipline, covering every aspect of the spatial distribution and organization of human activity. Through the work of Doxiadis Associates and two other organizations that he founded, the Athens Technological Organization and the Athens Center for Ekistics, Doxiadis was able to advance a comprehensive program of consultancy, applied research, publications, education, training and conferences in ekistics. This program was reinforced by the involvement of many leading intellectuals in the Delos Symposia, and by the foundation of the World Society for Ekistics in 1965 (BROMLEY, 2003). The rising volume of activ-

ity, discussion and publication in the ekistics movement helped build international support and interest for the first United Nations Human Settlements Conference held in Vancouver in 1976, and for the subsequent establishment of the U.N. Habitat Secretariat in Nairobi (SEARLE, 1980).

Ekistics embraces interior design, architecture, landscape architecture, urban design, civil and environmental engineering, planning, geography, and all applied social and environmental fields concerned with activity patterns in space, and with how people use, organize and create spaces. It stretches in scale from the room to the whole world. Unlike sociology, economics and other conventional academic disciplines, where many great minds have contributed a wide variety of different theories and principles, ekistics still consists mainly of Doxiadis' ideas. The merits of ekistics as an integrated field of study often become confused with the theories and principles which Doxiadis developed for the discipline.

During his lifetime, Doxiadis' intellect and energy dominated the field that he had visualized and established. If he had lived to a ripe old age, he might have gradually faded into the background as a senior statesman watching young scholars challenge his theories and develop new ekistic ideas. Instead, the discipline of ekistics is still very closely associated with Doxiadis himself, and with the terminology and theories that he developed. Many of Doxiadis' ideas were very insightful and have stood the test of time, but others are ripe for reconsideration. This article will evaluate one of Doxiadis' most controversial ideas – his axial urban growth (AUG) model, which he often called "the ideal dynapolis."

Doxiadis (1976a, pp. 5 and 32-47) used the prefix "dyna-" to indicate a rapidly growing urban area, differentiated by scale into dynapolis (towns and cities in the 5,000-200,000 range), dynametropolis (in the 200,000-10,000,000 range), and dynamegalopolis (a metropolitan region with over 10,000,000 inhabitants). He saw rapid world population growth and urbanization as pressing global realities, necessitating massive urban expansion and the foundation of new cities for at least 150 years. In numerous writings (e.g. DOXIADIS, 1967), he projected the tremendous growth of the world's population from about three billion in 1960 until its eventual stabilization at a figure between 15 and 50 billion sometime between AD 2100 and 2200. He also predicted that the world's population would shift from one third urban in 1960 to over 97 percent urban after AD 2100.

In Doxiadis' axial urban growth (AUG) model, outward growth from the original city center takes place in only one direction, along a gradually widening linear axis. This growth model is considered "ideal" because it creates a city with unlimited potential for expansion and with minimal needs for re-zoning

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and renewal (DOXIADIS, 1966a, pp. 53-72). Expansion is accommodated by extending the main transportation corridors, and by adding new "sectors" along the extended corridors. Each main transportation route is also a utility corridor. Each "sector" is a giant rectangular or square area up to two kilometers long and wide, bounded by major transportation and utility cor-

ridors, housing between 20,000 and 60,000 people, and having its main community facilities set in predominantly pedestrian areas towards the center of the area (DOXIADIS, 1963, pp. 106-115) (fig. 1). On a massive scale, Doxiadis' sectors resemble the neighborhood units and superblocks so frequently found in mid-20th century modernist planning (HOUGHTON-

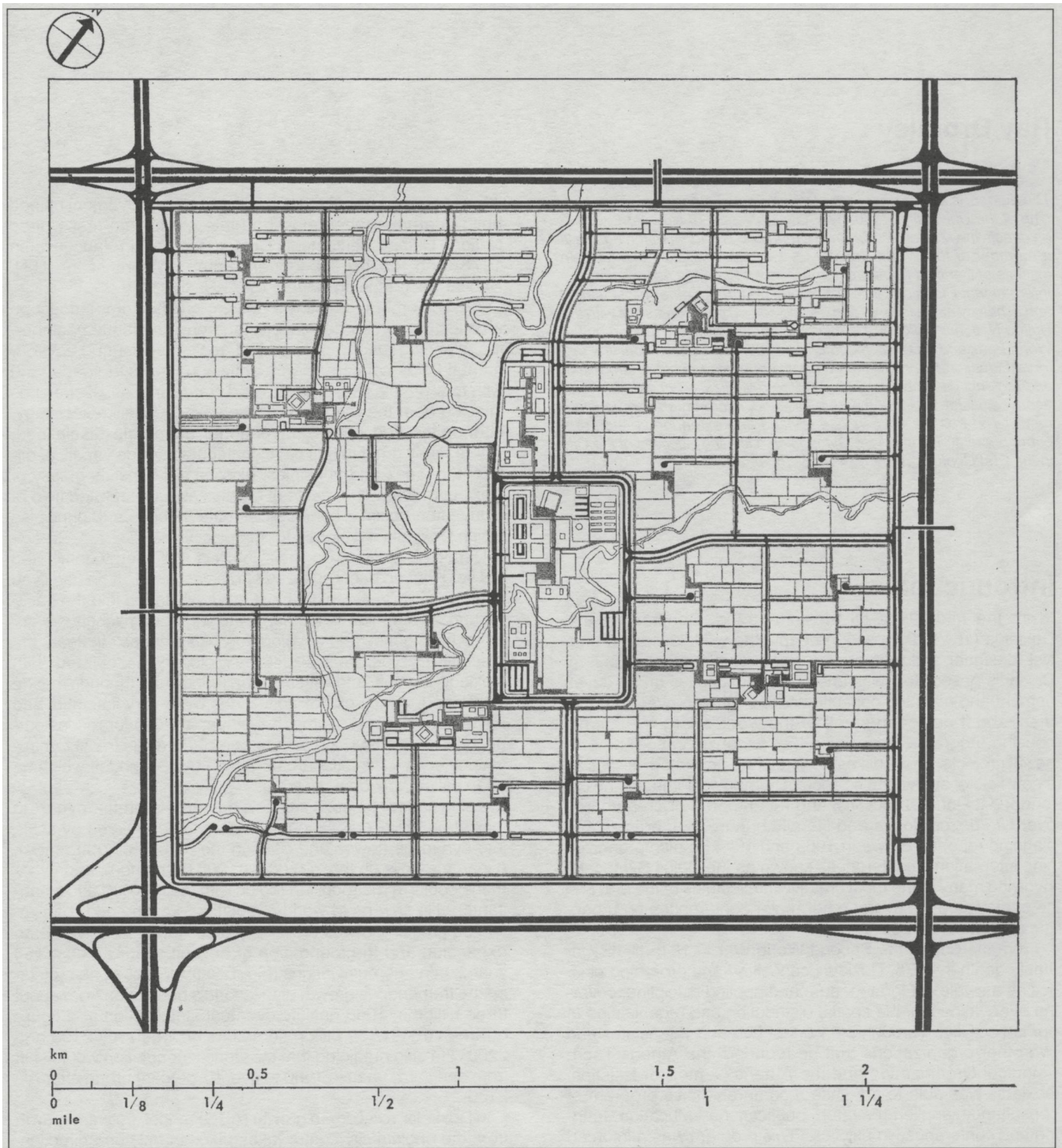


Fig. 1: A complete sector in Islamabad, bounded by transportation corridors and with a pedestrian-dominated institutional and service concentration in the center. (Source: Doxiadis, 1968, p. 361).

EVANS, 1975).

Doxiadis described the ideal dynapolis as “a parabolic settlement with uni-directional growth.” When he applied the uni-directional growth model to a rapidly-growing metropolitan area including both central city and suburbs (population 200,000-10,000,000), he called it “dynametropolis, the ideal city of the future.” He envisaged a group of metropolises, each growing uni-directionally, linking up with one another to form a dynamegalopolis, and eventually fusing to form the great global urban system of the future, which he called Ecumenopolis (DOXIADIS, 1968, pp. 364-380). The AUG model was a key component of Doxiadis’ most famous project, the design for Islamabad, the new Capital City of Pakistan, prepared in 1959-1960, and of most of his other new city projects and urban expansion plans.

Ekistics as field of study and channel for Doxiadis’ ideas

Doxiadis’ main ideas, as applied to ekistics and world development, can be summarized as 15 principles:

1. Human settlements have five elements: Anthropos (people as individuals), Nature, Society, Shells (buildings), and Networks (roads, utilities, transportation, communications and administrative boundaries).
2. Human settlements are organized in a 15-level nested hierarchy of “ekistic units” – man, room, dwelling, dwelling group, small neighborhood, neighborhood, small town, town, large city, metropolis, conurbation, megalopolis, urban region, urban continent, Ecumenopolis. The highest levels of the hierarchy are still in process of formation as functional units.
3. Settlements are rationally organized according to function, technology and scale, into a nested hierarchy of central places.
4. All problems and topics should be analyzed spatially and temporally, and conceptualized, whenever possible, in diagrammatic terms. Analysis is always facilitated by identifying trends and projecting them into the future, and by defining a scale of concern and then seeking to analyze problems at that scale, at the next smaller scale, and at the next larger scale.
5. Economic development, population growth, urbanization, technological progress, and globalization are inexorable forces in the world.
6. Global problems can be overcome by the concentrated effort and focused interaction of the most talented individuals from a wide range of disciplinary backgrounds. It is the task of the ekistician to gather these individuals and to focus them on the problems and potentials of human settlements.
7. The gap between rich and poor, both in specific countries and in the world as a whole, should be narrowed.
8. International organizations are important and must be strengthened, in the hope of eventually creating a world government.
9. National governments need to prepare national urban development strategies and national housing programs so as to accommodate and canalize the inevitable processes of population growth and urbanization.
10. Ekisticians should learn and implement the principles of environmental sustainability, taking advantage of renewable resources whenever possible.
11. Modern cities must be built with grid plans, a hierarchy of transportation and utility corridors, superblocks, and neighborhood units. These principles guarantee high levels of

functional efficiency together with “a human scale” at the local level – walkable, livable neighborhoods with public spaces and services to facilitate recreation and social interaction.

12. Cities should be dense and low-rise, with substantial provision of public transportation. Both high-rise development and automobile dependence should be avoided because they create congestion and fail to promote community.
13. Historic settlements and sites should be preserved by canalizing urban development elsewhere. They are vital elements of cultural heritage which help to maintain cultural diversity in the globalizing world.
14. Traditional urban growth is dysfunctional because the core areas of the city must be continually renewed as the periphery expands outwards. Instead of expanding in all directions, cities should expand preferentially in one direction, creating a gradually widening linear city known as the ideal dynapolis or dynametropolis. Such cities, exemplified by Doxiadis’ plans for Islamabad in Pakistan and Tema in Ghana, facilitate continuing growth without the need to demolish and rebuild existing areas.
15. World population growth and urbanization are proceeding very rapidly, and will continue for between 125 and 225 years, until a stable globalized situation called Ecumenopolis is attained. Ecumenopolis will be an interconnected global urban network with between 15 and 50 billion inhabitants, embracing almost all the world’s population and functioning as a single whole.

This article takes the first 13 principles as given and focuses its attention on principles 14 and 15, the visions of dynametropolis and Ecumenopolis. Principle 14 is the prime focus of analysis, but Doxiadis’ graphic vision of Ecumenopolis relies so heavily on the AUG model that principle 15 has to be pulled into the discussion of principle 14. Principle 15, in turn, is based on population projections and technological assumptions made before 1974, the year of publication of Doxiadis’ and Papaioannou’s highly-speculative work, *Ecumenopolis: The Inevitable City of the Future*. Three decades have lapsed since the publication of *Ecumenopolis*, revealing how prescient the book was in a few areas, for example the emergence of the Internet, and how exaggerated its forecasts were in other areas, notably global population growth, transportation technology, and economic and political integration.

The ideal dynapolis

Doxiadis’ vision of “the ideal dynapolis” was developed in the late 1950s as a reaction to the pace of world urbanization and the growth and renewal problems of traditional cities. Doxiadis (1960) assumed that cities and metropolitan regions were normally fast-growing and monocentric, focused on a central business district (CBD), and that they should remain monocentric. He knew of metropolitan areas which were polycentric conurbations, but he did not feel that they represented appropriate growth models. Instead, he idealized and advocated the monocentric metropolis focused on a CBD. Doxiadis recognized that several rapidly-expanding monocentric metropolises in proximity to one another might gradually merge their outer suburbs to form a continuous urban region with more than 20 million inhabitants and several separate CBDs, a phenomenon which he called megalopolis. The megalopolis concept was popularized by Jean Gottmann (1961) in his landmark book on the urbanized northeastern seaboard of the United States, stretching from south of Washington through Baltimore, Philadelphia and New York, to Boston and beyond.

Doxiadis used the prefix “the ideal dyna-” not only to indicate rapidity of growth, but also the capacity to continue growing

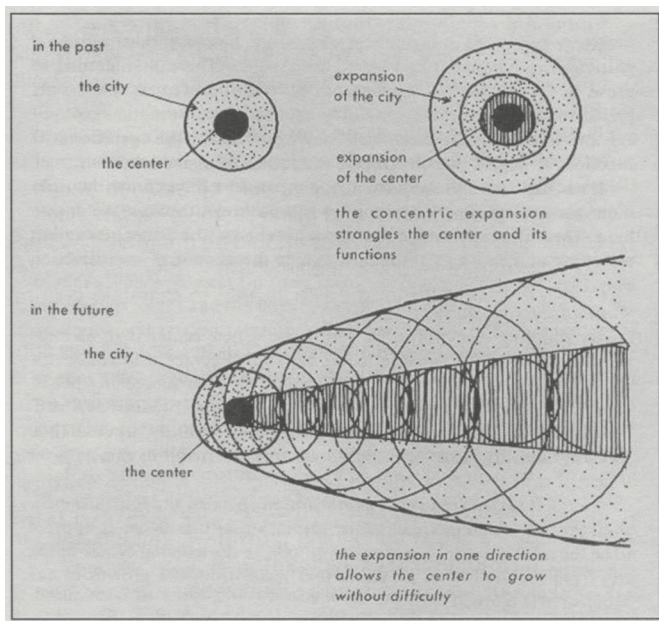


Fig. 2: Justification of the ideal dynapolis. Concentric expansion of settlements is not possible without increasing congestion and destroying inner city neighborhoods. Parabolic expansion of the city in one direction avoids congestion and saves most of the old neighborhoods. (Source: Doxiadis, 1966a, p. 56).

rapidly because new land and infrastructure would be made available for ongoing axial urban development. He saw the ideal dynapolis as a way of anticipating and solving the growth problems of expanding monocentric cities. He argued that when a monocentric city grows in all directions, population and traffic densities rise towards the center, transportation routes from the periphery to the CBD have to be expanded to carry additional traffic, and neighborhoods adjacent to the CBD have to be demolished so that the CBD can expand. As a result, the historic core and inner-city residential communities of expanding cities are gradually destroyed as major transportation and urban renewal projects replace the old fabric. Doxiadis' solution was remarkably simple – that the CBD and the whole city should expand in one direction, so that the traditional roughly-circular city is gradually converted to a linear city continuously growing in only one direction by the extension of transportation corridors and the addition of new sectors (fig. 2). This would preserve three-quarters of the old city, while facilitating the dynamic long-term expansion of the new city in one direction. The layout would favor the development and intensive use of mass transit systems along the linear transportation corridors, while creating new sectors as walkable neighborhood units alongside those corridors.

The linear city

The AUG model is a form of transit-oriented development, creating a linear city. The early development of this idea is usually associated with Arturo Soria y Mata (1844-1920), a Spanish intellectual and transit entrepreneur who first proposed linear cities in 1882 (fig. 3). His linear city projects were really streetcar suburbs, narrow transit-oriented developments in close contact with the adjacent countryside. Soria envisioned linking neighboring cities with linear urban developments, and he also wrote about the possibility of building linear cities thousands of kilometers long and linking such major

cities as Cadiz and St. Petersburg, or Beijing and Brussels (COLLINS and FLORES, 1968, p. 35). In 1892 he established a corporation to build a linear city, a 55 km-development running around three-quarters of the circumference of Madrid, and he eventually managed to build the first five kilometers of that city as a pilot project (COLLINS, 1959a, pp. 41-44). In 1897 Soria founded the journal *La Ciudad Lineal*, arguably the world's first journal of urbanism, and it continued to be published through till the early 1930s. Soria worked to build an international network of linear city advocates, and his mission was continued in the 1920s and 1930s by the Spanish author Hilarión González del Castillo and the French architect-planner Georges Benoît-Lévy. Benoît-Lévy (1929) developed proposals for both garden and linear cities in the Paris Metropolitan Region and other parts of France. Although built to be separated from Madrid by areas of undeveloped rural land, Soria's pilot linear city has been swallowed up by the expanding metropolis and it is now simply a neighborhood of the city.

In 1910, the American author Edgar Chambless published *Roadtown*, proposing a single two-storey megastructure building with a monorail personal rapid transit system in the basement and a promenade street along the roof, potentially stretching for hundreds of miles, or even across the Continental United States. Chambless (1910) was probably unaware of Soria's work, but in the 1930s and 1940s Le Corbusier (1933/1967, pp. 221-227; 1946, pp. 69-75) embellished both Chambless' and Soria's ideas to produce visions of linear megastructures snaking across the cities of Buenos Aires, Montevideo, São Paulo, Rio de Janeiro and Algiers, and linear urban developments linking all the major cities of Europe into a continuous urban network (fig. 4). Meanwhile, N.A. Miliutin (1930/1974) proposed linear industrial cities in the Soviet Union, the British CIAM Group developed its MARS Plan for parallel north-south linear extensions of the City of London (KORN and SAMUELY, 1942), and Ludwig Hilberseimer (1949, pp. 134-194) made many alternative proposals for linear urban forms. Arthur Korn (1953), George Collins (1959), Jacqueline Tyrwhitt (1963), and William Houghton-Evans (1975) have all developed extended reviews of the linear city theme, and Tyrwhitt and Houghton-Evans both discuss Doxiadis' ideal dynapolis in their review. Houghton-Evans (1975, pp. 131-156) also introduced circuit linear (loop) models for linear cities of finite size, arranged in a circle, oval or figure-of-eight shape. Such ideas were widely discussed among British new town planners in the 1960s and 1970s. They offered the prospect of efficient cities with easy access to open space, but they required the construction of another new city every time that an existing planned city reached its finite target population.

Over the last 120 years there has been a tremendous amount of writing about linear cities, including numerous proposals for new linear towns and linear urban expansions. Nevertheless, very few planned linear cities have ever been built, and this seems to indicate fundamental resistance to linear urban forms. Part of the resistance may be simple conservatism, favoring traditional rounded and rectangular forms, and rejecting the idea that any single designer should determine the growth pattern of an entire city. Another part of the resistance may be skepticism that linear master plans can ever be implemented, and that linear cities can ever attain effective governance. Most importantly of all, however, there is a profound critique expressed in Christopher Alexander's (1966) classic article "A city is not a tree," which argues that planned linear models are fundamentally over-simplified, ignoring the complexity, diversity and constantly changing character of contemporary life.

The paradox of planned linear cities, so often proposed and so little built, is further compounded by the prevalence of spontaneous linear developments along inter-city roads throughout

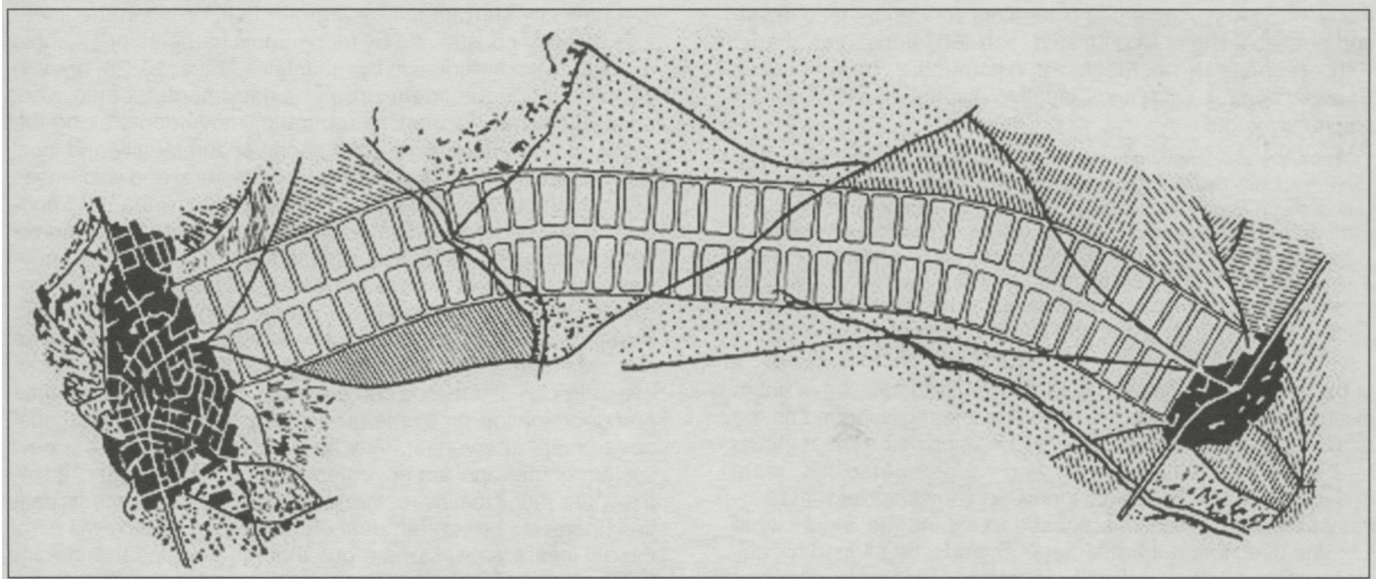


Fig. 3: One of Arturo Soria y Mata's linear city visions prepared around 1911. Parallel rows of residential superblocks are built along a central boulevard with a tramway, linking two existing towns. (Source: Boileau, 1959, p. 231).

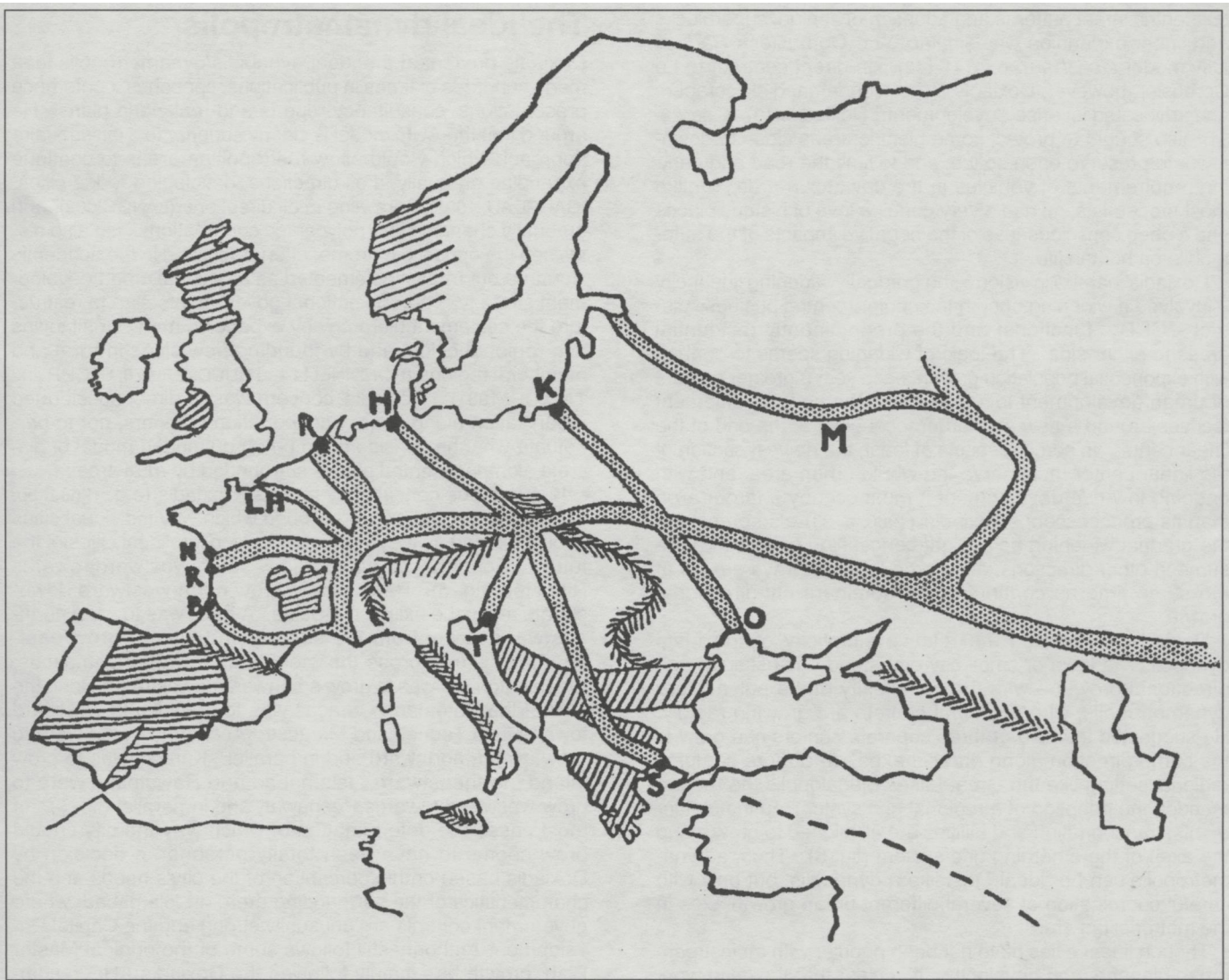


Fig. 4: Le Corbusier and ASCORAL's vision of Europe and its linear "route-cities," prepared around 1942. (Source: Le Corbusier, 1946, p. 75).

the world. Most planners and scholars condemn these developments as unsightly, congested, polluted “strips” and “drags” with no sense of aesthetics or community. In his classic *England and the Octopus*, Clough Williams-Ellis (1928, p. 162) poignantly wrote:

There is surely something rather noble about the broad white concrete ribbons laid in sweeping curves and easy gradients across the country ... But in the buildings that quickly crop up on either hand there is nothing at all noble or satisfying. Whether bungalows or garages, tea-shops or villas, their nastiness is assured. It is this uneconomic “ribbon development” along the main roads that is so rapidly destroying such country amenity as is still left near our growing towns ... The disfiguring little buildings grow up and multiply like nettles along a drain, like lice upon a tape-worm.

In his writings applying the AUG model, Doxiadis chose not to discuss or acknowledge the history of linear city ideas and the related works of other scholars. His version of the linear model had some original elements, and he presented his “ideal dynapolis” as a truly original innovation, uncluttered with alternative visions. Doxiadis proposed to extend the linear city in just one direction, rather than at both ends, he aligned his city along transportation and utility corridors (utilidors), and he had specific design and size recommendations for “sectors” as giant superblocks functioning as neighborhood units. He envisaged “parabolic expansion” – that the city would grow progressively wider as it grew longer. His rejection of radial-concentric street patterns and adoption of zoning, superblocks and linear expansion was similar to Le Corbusier’s *Radiant City* model (1933/1967, pp. 141-142). In direct contrast to Le Corbusier, however, Doxiadis (1973) condemned skyscrapers and advocated low-rise development. Doxiadis (1976a, pp. 22-51) also sought to protect some historic areas close to downtown, to preserve open space, and to limit the road and parking requirements of vehicles in the downtown area. Unlike most modernists, he had a very genuine love of historic places and a deep consciousness of the negative impacts of the automobile on human life.

Doxiadis’ parabolic vision – the gradually widening linear city – involved a widening of both the center (central business district – CBD – functions) and the predominantly residential areas to either side. The logic of widening seems to be that, with exponential population growth, each year a greater amount of urban development is needed, and the new development focuses around a new and larger focal point at the end of the linear center. In some respects at least, the newest section of the linear center must serve the whole urban area, and with ongoing low-rise development it must occupy a larger area than its predecessors. Doxiadis (1960, p. 38) also presented the gradual widening as a slight concession to growth pressures in other directions, allowing a little sideways growth at the same time as continuing the dominant uni-directional growth.

Doxiadis contrasted the relative simplicity of the ideal dynapolis – a town or small city embarked on sustained uni-directional growth – with the complexity of the polynuclear dynametropolis, where several centers are growing rapidly. He suggested that two or three separate centers can grow in the same direction along parallel axes. In a more complex regional setting like the Great Lakes Megalopolis, he recommended the adoption of a regional grid system, so that settlements, transportation and utilities are all aligned to grow along the axes of the emerging grid system (fig. 5). Thus, a dynametropolis can be “ideal,” just like a dynapolis, but only with careful coordination of several different urban growth axes in the metropolitan area.

Though linear cities have not been popular with mainstream urban planners and developers, it is clear that they can work on a modest scale. Success is most likely when the linear city

is a new city surrounded by a green belt, or when the linear axis is tightly constrained by topographic barriers, for example a coastal strip hemmed in by mountains. Five, 10, 20, or even 30 km continuous linear urban developments should work quite effectively, facilitating commuter movements along the linear corridor, retaining a clear sense of community and local identity, and facilitating access to coastal, rural and wilderness areas to the sides. Within these scale limits a linear metropolis can be a single municipality, or more probably several municipalities coordinated by some loose form of metropolitan government, including a transit authority. The national government is probably involved in the planning or designation of the linear metropolis, but it does not need to be involved in day-to-day management. If the linear metropolis grows larger, however, all sorts of tensions can emerge. Inter-municipal rivalries and coordination problems grow in significance, and national government intervention may be necessary to impose a new system of metropolitan governance. If the new model is a single linear municipality, replacing formerly separate municipalities, there will be a great deal of resistance. Critics will extol the old local identities and argue that the new linear metropolis fails to create a sense of democratic community. The longer the metropolis, the greater and more complex the problems of internal coordination and external liaisons.

The ideal dynametropolis

Doxiadis presented the ideal dynapolis/dynametropolis idea many hundreds of times in publications, speeches, conference presentations, consultancy reports and real-world plans. He argued that the AUG model is clearly superior to a laissez-faire approach which would allow metropolitan areas to continue expanding gradually in all directions, developing “edge cities” (GARREAU, 1991), sprawling in all directions (LANG, 2003), and gradually changing into polycentric conurbations. He also dismissed the opposite extreme, often discussed in the academic literature but rarely implemented as a national urban development strategy, whereby national governments plan to restructure the settlement hierarchy by expanding many small towns into regional cities, and by founding new cities in rural and peripheral regions (RONDINELLI and RUDDLE, 1978; STÖHR and TAYLOR, 1981). Doxiadis’ concern was to direct accelerated urbanization along major transportation corridors, not to perpetuate what he considered to be an outmoded model of discrete, compact central places surrounded by rural areas.

In numerous consultancy reports, Doxiadis (e.g. 1966a, pp. 63-69; 1968, pp. 364-377) prescribed which way individual cities should expand as they were transformed into ideal cities of the future. Copenhagen was to grow south-westward towards Ringsted (fig. 6). Paris was to grow north-westward downstream along the axis of the Seine. Athens was to grow north-eastward, away from the sea. Beirut was to grow east-southeastward across the mountains towards Damascus. Washington DC was to grow southward downstream along the axis of the Potomac. Caracas was to grow south-westward towards Los Teques and Maracay. Accra and Tema were to grow inland, northward and in parallel. Karachi was to grow inland, northeastward. Islamabad and Rawalpindi were to grow westward towards Peshawar, and in parallel (fig. 7). In most cases the determination of which way the city should grow seems to have been totally personal, a decision by Doxiadis based on his perception of the city’s needs and the characteristics of the surrounding area. In Islamabad, where government controls are unusually strong and the Capital Development Authority still follows some of the original Master Plan, growth has mainly followed the Doxiadis AUG recommendation (YAKAS, 2001). In all of the other cases around the

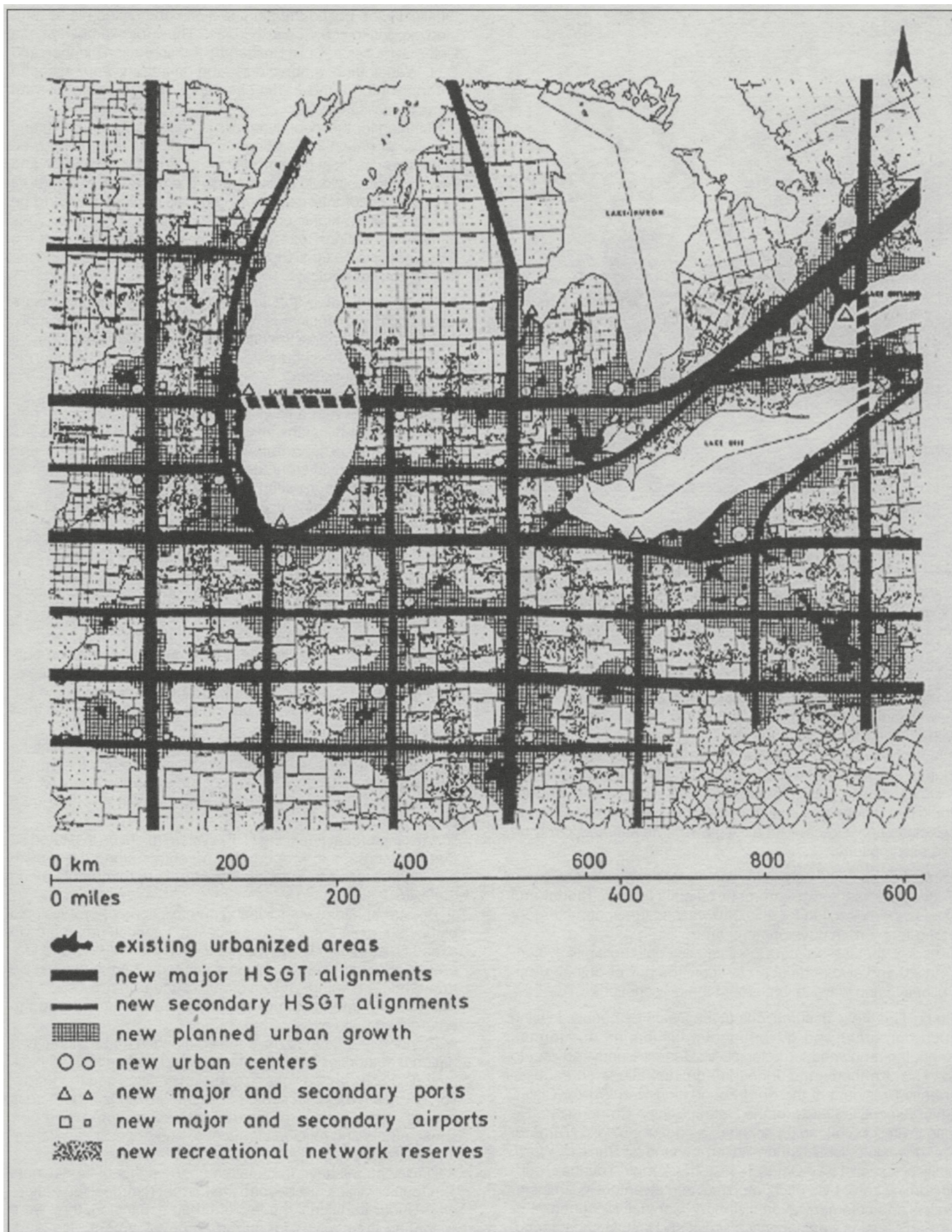


Fig. 5: A schematic presentation of possible organized growth for the emerging Great Lakes Megalopolis. (Source: Doxiadis, 1976b, p. 77).

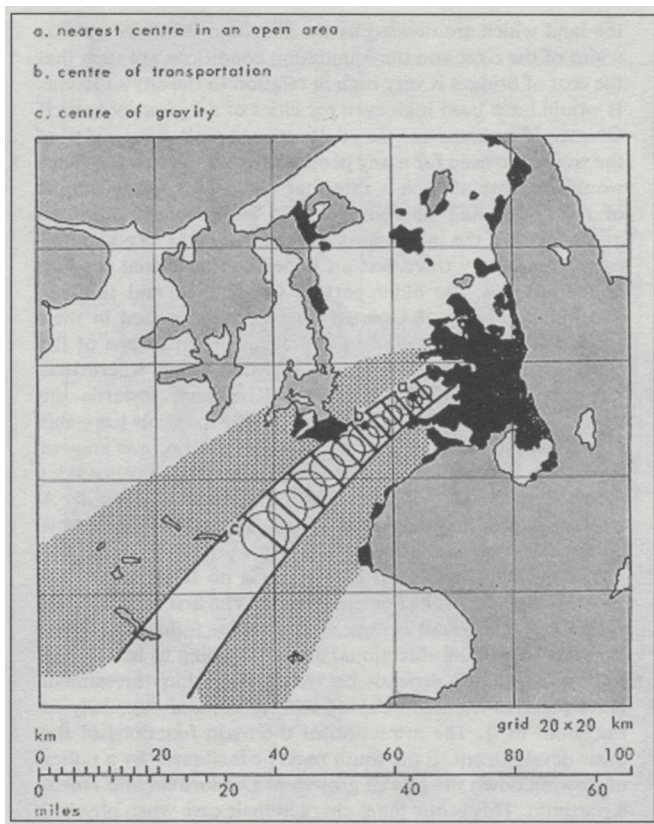


Fig. 6: Proposal for uni-directional growth of Copenhagen. (Source: Doxiadis, 1968, p. 473).

world, however, even including Islamabad's sister city of Rawalpindi, growth since the 1960s has been in all directions, with no special priority to the direction prescribed by Doxiadis. It is much easier to prescribe which way a city should grow than to ensure that the prescription is followed!

Doxiadis was generally vague on how the ideal dynapolis could be planned and implemented, and particularly on how to select the right direction for axial growth. He seemed to rely on two assumptions:

- first, that he could convince opinion-leaders, business executives and senior government officials that his model and prescribed direction for axial growth was the right pattern for long-term urban development; and,
- second, that the greatest intellectuals could be similarly convinced and also persuaded to apply the power of their disciplines to find ways to implement the prescriptions.

He built on these assumptions at the Delos Symposia, inviting such corporate and governmental luminaries as Herman Kahn, the renowned futurologist, McGeorge Bundy, adviser to the U.S. Kennedy and Johnson administrations and subsequently President of the Ford Foundation, and Walker Cislér, Chief Executive Officer of the Detroit Edison Corporation. He also invited such leading scholars as anthropologist Margaret Mead, sociologist Suzanne Keller, economist Barbara Ward, political scientist Karl Deutsch, historian Arnold Toynbee, public administrator Lyle Fitch, architect and inventor Buckminster Fuller, and communication visionary Marshall McLuhan. For Doxiadis, Delos was not only a social and scholarly gathering, but also a model of how leading experts in different disciplines could work together to analyze common problems. Charac-

teristically, he posed the big questions and asked his assembled experts to come up with ideas. Thus, for example, at one Delos Symposium, Colin Buchanan, transportation planner, and C.H. Waddington, embryologist and geneticist, were asked to compare blood and traffic circulation and to come up with ideas to facilitate flows.³

Planning for the ideal dynapolis is necessarily top-down and regional or national. Existing municipalities might be allowed to continue as local governments, but strong coordination and legal mandates would be required. The decentralized Tiebout (1956) model of inter-municipal competition would have to be replaced with a highly centralized AUG model which assigns municipal functions and requires close coordination. For the AUG model to be applied, planning would need to have the following characteristics:

- A highly-educated and impartial corps of professional planners, architects, engineers and lawyers, working in the public interest, will determine the future pattern of urban development and supervise the subdivision of land and the installation of infrastructure networks.
- All infrastructure easements should be dimensioned to accommodate the future flows of a continuous global urban network, rather than just the immediate needs of the actual population. Major transportation corridors should be wide and straight, and should carry the trunk power lines, water mains, sewers and communication cables.
- No urban development should take place in areas not authorized for development and not provided with infrastructure. All landowners and real estate developers should know which areas are prescribed for urban development, and which are not to be developed. Urban expansion plans must have legal approval, and strict penalties must be approved and enforced so as to ensure that no urban development takes place outside authorized areas.
- Powers of eminent domain and strong anti-corruption policies will be needed to ensure that landowners along the urban growth axis do not speculatively raise land prices to take advantage of the fact that the growth axis must pass over their property.
- Real property taxes will need to be reassessed so as to take account of the increase in value of properties along the growth axis, and the reduction in value of properties in areas where urban development was anticipated but will not now take place.
- A tax increment financing (TIF) system might be instituted so that the increase in property tax revenues along the growth axis can be used to fund infrastructural improvements along the axis.
- Bi- and tri-lateral coordinating commissions of professional planners should determine how best to interlock urban growth axes across national boundaries until the eventual world federation or government is able to supersede them and exercise true global planning. International standards are needed to facilitate the interlinking of infrastructure systems along the emerging growth axes.
- Planners will need to have the confidence that regional and national authorities, and eventually world authorities, will back their decisions on the linear expansion of cities and the formation of growth axes. In some cases the growth axes will cross sacred areas, historic areas, delicate ecosystems, and personal, ethnic and religious territories, and opposition will have to be over-ruled.
- Decisions will have to be taken on the rights of landowners and municipalities just beyond the current metropolitan periphery. Under traditional models of urban expansion, they were preparing themselves for suburban development. Do landowners deserve compensation because their expectations to sell for urban development are now permanently frustrated?

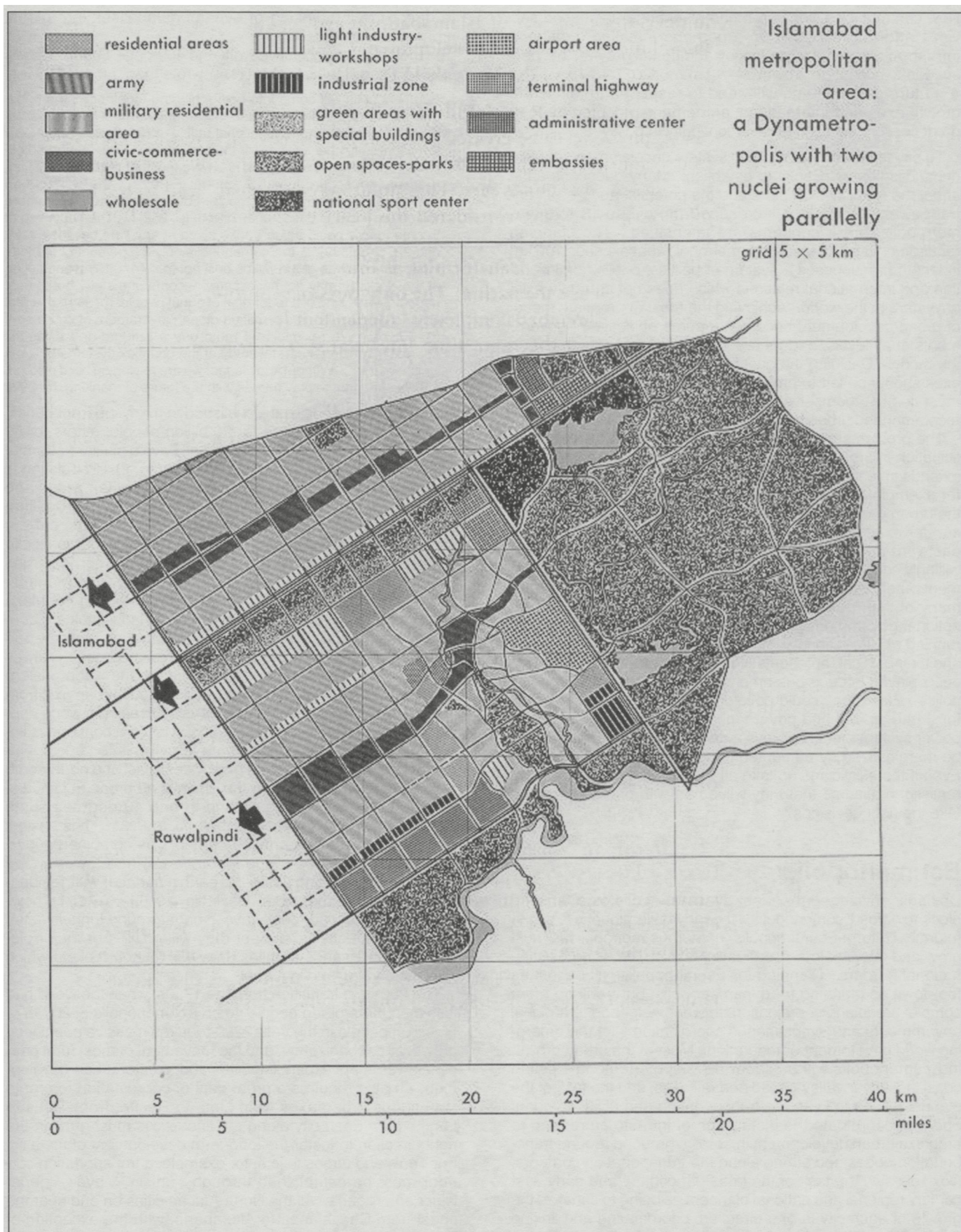


Fig. 7: Proposal for parallel uni-directional growth of Islamabad, Rawalpindi, and the linear park and institutional area which separates the two cities. (Source: Doxiadis, 1966a, p. 63).

How can municipalities which had planned for increased services and tax revenues, and perhaps installed additional infrastructure in anticipation of additional growth, be persuaded to accept no growth?

- Future governments will need to respect and follow the growth axes and international agreements adopted by their predecessors, so as to ensure continuity in policy.

To say the least, the planning system necessary for an ideal dynapolis seems difficult to establish. Many questions arise about the fallibility of experts and the potential abuses of central power. As scale is increased from dynapolis to dynametropolis, these concerns are intensified. The planning requirements for an ideal dynametropolis that exceeds 100 km in length presupposes a system of politics, public administration and international relations which does not currently exist anywhere in the world. Achieving the most appropriate model of urban development becomes a prime objective of governments at all levels, and there must be general agreement on the model. Deciding the orientation and design of the growth axes should be left to professional experts, and governments must commit themselves to long-term implementation of the recommended urban development policies.

The problems of urban identity and democratic citizen participation in urban governance multiply as the dynametropolis extends in length, stretching from Paris to Lyon and Marseille for example. These problems are further complicated when the urban growth axis crosses national frontiers, as would occur, for example, from Marseille westward to Barcelona and eastward to Genoa. Local and regional governments must willingly cede many of their current powers to national government, and national governments, in turn, must willingly cede many of their powers and revenues to some form of supranational government or federation which ensures the smooth running of international dynametropolises. The general public and their political representatives will lose any roles they previously played in decisions on urban and regional development policy. Ekisticians could develop all the long-term strategies for urban growth and governance, but in such a centralized power system there is always a danger that the ekisticians will be marginalized by authoritarian politicians or military rulers. Even if the ekisticians do take all the important decisions, is it realistic to assume that they will agree with one another and take the right decisions?

Ecumenopolis

Doxiadis envisaged the ideal dynametropolis as a building block towards Ecumenopolis, "the inevitable global city of the future." To form Ecumenopolis, numerous metropolises must grow and interlink in a coordinated fashion, crossing existing national borders. Planning for Ecumenopolis will be just as top-down as planning for dynametropolis, but it will be more complex, requiring coordination between neighboring national governments and simultaneous coordination with the emerging world government or federation. Most of the urban growth in Ecumenopolis will be linear development along existing coastlines, river valleys, road and rail axes, and the task of the planner will be to keep the transportation and utility corridors open, to coordinate the installation of infrastructure, and to organize urban development in sectors grouped around transportation nodes and strung along the transportation corridors. Doxiadis saw the task of the late 20th century and early 21st century regional and national planners as being to canalize the growth of each city in one direction, coordinating and linking different growth axes to create a dynametropolis, and linking different dynametropolises into a dynamegalopolis. In turn, he saw the task of late 21st and 22nd century planners as being

to direct the interlinking of dynamegalopolises into global urban networks (fig. 8).

In their highly speculative work, the 469-page *Ecumenopolis*, Doxiadis and Papaioannou (1974) wrote that:

Ecumenopolis will come into being, binding together all the habitable areas of the globe as one interconnected network of settlements operating as one functional unit ... We selected and calculated three ultimate ceilings for the population ... 20, 35 and 50 billion people respectively. (p. 247) ... We feel that the most likely figures are those produced by model F-20; ... the point when Ecumenopolis begins will be reached by the year 2100 when there will be a world population of 20 billion. (p. 252) ... The beginning of Ecumenopolis could actually take place at any time between 2100 and 2200. (p. 339) ... In Ecumenopolis only 2.5 percent of the total land surface of the globe will be built up. (p. 344) ... The population of the world ... may not necessarily become one state, but it must become some kind of a federation of equal people. (p. 344) ... A real Ecumenopolis will need a unified global government of some sort. (p. 388) ... We (ekisticians) must use a rational and scientific approach, making a careful study of the complex systems of life in which we live ... Without knowledge, we are relying on blind chance, and it is not right to play games with the future of mankind. (p. 397)

Maps of Ecumenopolis are published in many different books, articles and reports, some for 20 billion people, others for 50 billion.⁴ They vary significantly, but all have a similar pattern of population distribution across the world (fig. 9). Population is concentrated in existing cities and metropolitan areas and along linear axes connecting those cities and metropolitan areas. Thus, for example, Lima on the Pacific Coast of Peru becomes connected by a continuous urban corridor to Recife on the coast of north-eastern Brazil, and the corridor runs through Pucallpa to Iquitos, down the Amazon to Manaus, Santarém and Belém, and then along the coast to Fortaleza and Recife. Similarly St. Petersburg and Vladivostok are connected by an urban corridor which runs through Moscow and Sverdlovsk, and along the axis of the Trans-Siberian Railway through Omsk, Novosibirsk, Krasnoyarsk and Khabarovsk to Vladivostok. All versions include a continuous urban axis from Cairo to Cape Town, and the versions envisaging a world population of 50 billion in the year 2200 envisage a continuous linear city running across the Sahara from Tunis to Lagos. The world pattern approximates a grid of west-east and north-south populated axes, overlaid on the global land areas at latitudes between roughly 65 degrees north and 40 degrees south (DOXIADIS and PAPAIOANNOU 1974, pp. 374-381). It is easiest to envisage the transportation corridors as combined super-highways, high-speed long-distance rail and lower-speed commuter rail running along the earth's surface, with residential sectors on either side. Doxiadis (1966b, pp. 76-77), however, recommended "deepways ... underground tunnels ... the higher the speed, the deeper they will go ... For major distances of thousands of miles, they will rely on rockets which will take off and land in tunnels."

The 250-year transition from the 1950s, when the world had less than three billion people, to an Ecumenopolis of 20, 35 or 50 billion people in the year 2200 requires massive population growth and urbanization, and the movement of most rural peoples towards the expanding cities and axes of urban development. It also requires a great deal of coordination to create continuous urban axes from Lima to Recife, from Tunis to Lagos, etc. Each city along the linear axis must grow in the right direction to foster the long-term development of the axis. For Tunis and Lagos to join, for example, a transportation corridor must be established through Tunisia, Libya, Algeria, Niger and Nigeria. All the North African cities on and near the coast from Casablanca to Alexandria, with the exception of Tunis, should grow along the coast to create a continuous urban axis. Tunis, however, should grow southward across the Sahara. Lagos should grow north-northeastward to merge



Fig. 8: Theoretical configuration of global axes and centers for the Western Hemisphere portion of Ecumenopolis. The grid-like lines in North and South America are projected axes of urban development. The shaded and stippled areas are zones where extreme cold, heat or elevation, or freshwater scarcity limit intensive urban development. (Source: Doxiadis and Papaioannou, 1974, p. 380).

with Ibadan, Kaduna and Kano, and then directly northward to meet the southward-expansion of Tunis. There should be no expansion southward of Algiers, or directly northward from Lagos towards Algiers. Thus, each city has a prescribed direction of expansion to facilitate the development and efficient

functioning of Ecumenopolis. Lack of coordination would lead to disconnected urban spurs, for example a 1,000 km southward expansion of Algiers which does not link with anywhere in West Africa because no West African metropolis expanded northward to meet that spur.

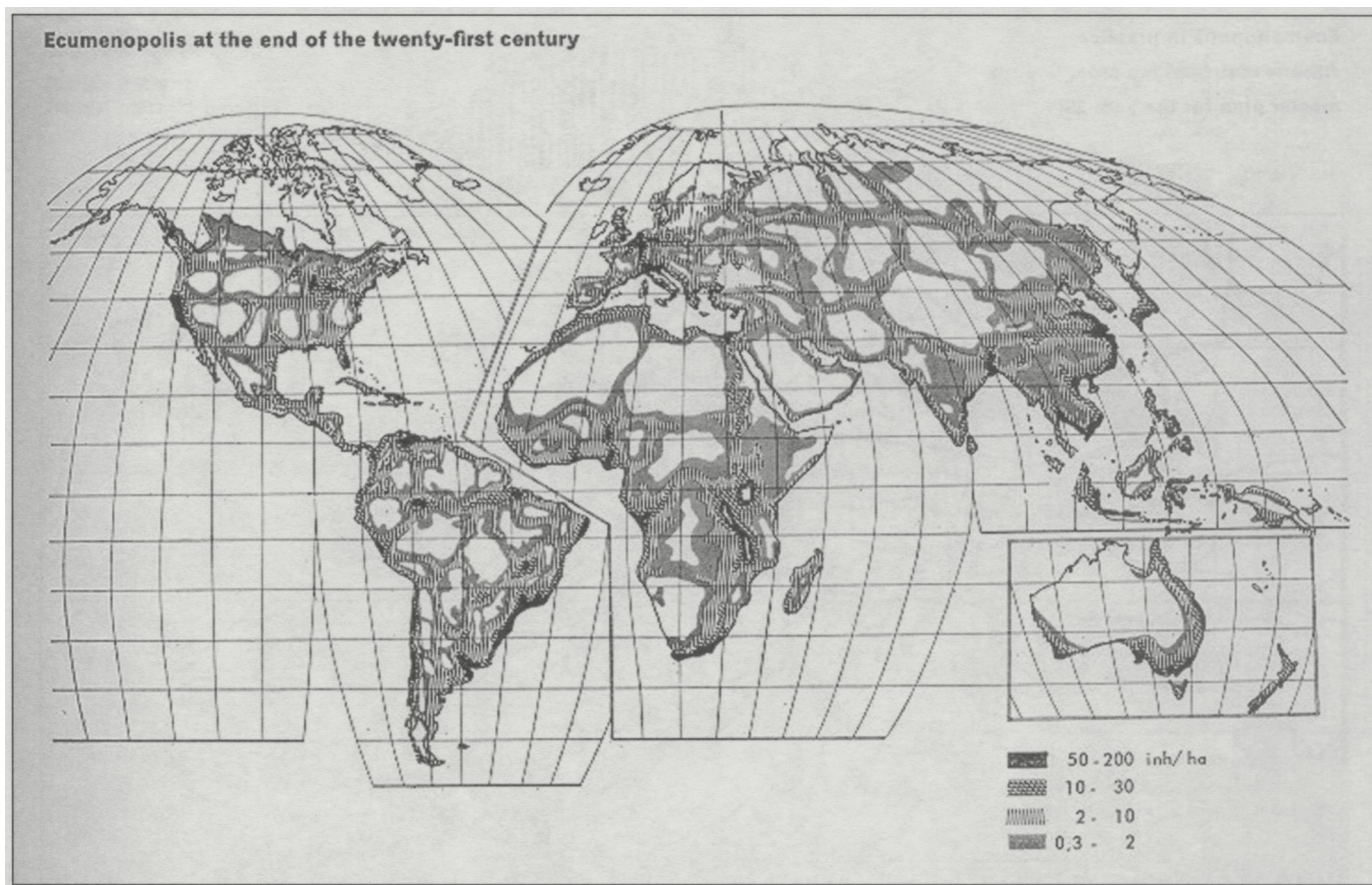


Fig. 9: Ecumenopolis at the end of the 21st century. (Source: Doxiadis, 1968, p. 377).

Doxiadis and Papaioannou (1974) suggest that Ecumenopolis will rely mainly on nuclear power (p. 209), sophisticated computer and communications technologies (p. 333), and inter-linked transportation, utility and communication networks, which might be termed "coordinets." (p. 333) They assert that "Anthropos' only long-term hope is to establish a genuine partnership with Nature; his destiny is inextricably linked with that of the biosphere, that fragile and infinitely complex living system which forms the organic skin of the planet." (p. 340) In ecological terms, however, the idea of the world's land surface being segmented into discrete rural and wilderness areas by continuous networked axes of urban development is very troubling. Natural habitats would be broken up, interrupting the migration patterns of animals and the reproduction of plants, causing many plant and animal species to become extinct, and reducing biodiversity. Drainage and flooding patterns could also be dramatically altered and prime farmland would be lost, notably along major rivers such as the Amazon and Nile, and along many coastlines.

With three decades of hindsight, Doxiadis' and Papaioannou's vision of Ecumenopolis seems far-fetched. World population growth has fallen, it is difficult to imagine how growth rates and energy technologies could facilitate even 15 billion people living in harmony with the biosphere, and "a world federation of equal people" seems increasingly remote. Some of their specific prognoses seem absurd, for example that: "The goal will eventually be reached when Anthropos can travel within the whole of Ecumenopolis in 40 to 50 minutes, traveling through tunnels or maybe a satellite for the longest distances between primary centers at 20,000 km (12,400 miles) per hour." (p. 349)

While the speed of travel within Ecumenopolis was pre-

dicted with spurious precision, Doxiadis and Papaioannou were extraordinarily vague about the socio-political changes which would have to take place to facilitate the development of Ecumenopolis. Statements were couched in very general terms. In Chapter 43, entitled "The Big Questions," for example, the authors wrote (pp. 392-393):

An enormous number of questions remain to be answered before we can be certain about the future and certain about a successful Ecumenopolis, too many by far for us to deal with here. Anthropos must answer all these questions gradually and in a wise and successful way if he is to achieve that future which we know it is possible for him to achieve ... Despite his present screaming and crying Anthropos does know what he wants – higher incomes and improved technology ... We are attempting to realize dreams of world unification without knowing how to do so, nor how to save what Anthropos has created during his long history ... Ecumenization inevitably is the next phase for Anthropos. It will give him the opportunity to take the next big step forward in his evolution, but it will also make it possible for him to destroy himself completely unless he opens his eyes to what is taking place.

Writing in 2003, almost 30 years after the publication of *Ecumenopolis*, it is obvious that Doxiadis and Papaioannou (1974) over-estimated the world's population growth and eventual demographic peak. They correctly foresaw ongoing economic and cultural globalization, and the significance of new communications technologies. From the viewpoint of ekistics, however, their most obvious weakness was their conception of the urban form of Ecumenopolis. Just as the economies and societies of Los Angeles and Tokyo can be closely interlinked through telecommunication, the Internet and the aeroplane, without any physical urban bridge across the Pacific, the economies and societies of Paris, Berlin and Moscow can be

closely interlinked without axial urban growth between the three. Transportation corridors for road and rail do not need to be urban corridors, and most personal and business communication will be through advanced telecommunications, including the Internet, and by air. The overland transportation corridors that unite Moscow and Vladivostok, or Cairo and Cape Town, serve for many local overland passenger and freight connections, and for some long-distance heavy freight connections, but they do not form a useful basis for urban development. The safety, efficiency and aesthetic quality of these corridors may be enhanced by their being "townless highways" rather than linear cities (MacKAYE and MUMFORD, 1931). If Doxiadis' far-fetched vision of deepways and rocket transportation becomes a reality, it is even harder to imagine why settlement should be extended along the earth's surface above the deepway tunnels and below the lines of rocket flight. High speed vehicles travel from point to point, and it is only at specific points that people can board or disembark.

A form of Ecumenopolis may well come into existence sometime in the future, but there is no good reason for it to be a physical grid of linear cities stretched across the world's land surface. Instead, it will be a galaxy of metropolitan regions, tightly interconnected by transportation and telecommunications, but not physically united by linear urban axes. A continuous linear city from Tunis across the Sahara to Lagos is unappealing in every sense – socially, culturally, politically, aesthetically and, above all, environmentally.

Conclusion

When magnified to immense proportions and linked to visions of Ecumenopolis, the AUG model has no merits. It appears as nothing more than an eccentric spatial vision. It is easy to understand why Doxiadis proposed the model to provoke thought and discussion, but it is difficult to take it seriously as an ideal urban form.

When limited to a much more local scale – perhaps with a maximum length of 50 km – the application of the AUG model to create the ideal dynapolis and ideal dynametropolis is at least a possibility. It can form the basis for a new linear city, built in a sparsely populated region, and it may be an appropriate urban development model for some transportation corridors with substantial topographic barriers on both sides. In most cases, however, it is just one of many alternative growth patterns, and it is unlikely to be selected unless it is imposed by a higher level of government and backed by strong legal powers. It works against the conventional logics of market forces and democratic decision making, imposing a very strong set of planning controls to channel urban development in one direction and to prevent developments in other directions.

The original justification for the ideal dynapolis focused on the preservation of historic downtown and inner city neighborhoods, and the maintenance of a monocentric metropolitan form. The ideal dynapolis model converted the CBD from roughly circular to linear in form, and it limited the demolition of traditional neighborhoods to one quarter or less of the total. Nowhere in the world, however, has this model been followed as a deliberate strategy of urban renewal combined with historic preservation. The model requires strong central powers and long-term continuity in planning and implementation. It also ignores many of the alternatives which have emerged in cities around the world. In reality, all major metropolises are now polycentric, with one or more downtown business areas, several neighborhood centers and commercial strips, and some development of drive-in retailing near the edge of the metropolitan area. The old downtown may be preserved, but

gradually converted from general retailing to speciality retailing, perhaps focusing on heritage tourism. Many cities have some degree of axial growth, and so downtown may gradually expand in one direction and shift its center of gravity in the process, but the axial development of downtown does not preclude urban expansions in other directions, especially on the metropolitan periphery. As cities grow, old structures may be adaptively re-used for new purposes, and old neighborhoods may be revitalized as gentrified historic areas or densified as rental slums. The variety of urban development rates and forms around the world is so diverse and rapidly-changing that it is difficult to imagine how a brilliant ekistician could come to any city, determine the pattern of long-term urban development, and then persuade the local business and political leaders to change all the laws to enforce that development model. It is even more difficult to imagine how future generations would agree to conform to the visions of their predecessors. Real-world politics, urban development and technological change are messy, but fascinating subjects for ekistic analysis. The long-term future is well worth discussing, but contemporary ekisticians should not delude themselves that they can predict enough to establish models of urban form which should be implemented for a century or more. Ekistics does not need the AUG model or any specific physical vision of Ecumenopolis in order to justify its existence as a field of study and professional practice.

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Notes

1. The author can be contacted at «r.bromley@albany.edu».
2. The Delos Symposia from 1963 till 1975 are all extensively reported in *Ekistics*. The 1975 Symposium was held shortly after Doxiadis' death and served as a memorial and tribute to his life and work. In 1973 there was no Delos Symposium, but Doxiadis organized a smaller event called the City for Human Development Symposium (*Ekistics*, vol. 35, no. 209, April 1973). Examples of other major conferences and volumes which served as springboards for Doxiadis' ideas include the Mayo Centennial Symposium (Doxiadis, 1965), Arnold Toynbee's (1967) *Cities of Destiny*, David Lewis' (1968) *Urban Structure*, and the Fourteenth Nobel Symposium, held in Stockholm in September 1969 (Tiselius and Nilsson, eds., 1970).
3. The author is indebted to Panayis Psomopoulos for this example.
4. See, e.g. Doxiadis (1968, p. 377; 1972, pp. 56-57); Doxiadis and Papaioannou (1974, pp. 38-39 and pp. 360-363).

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