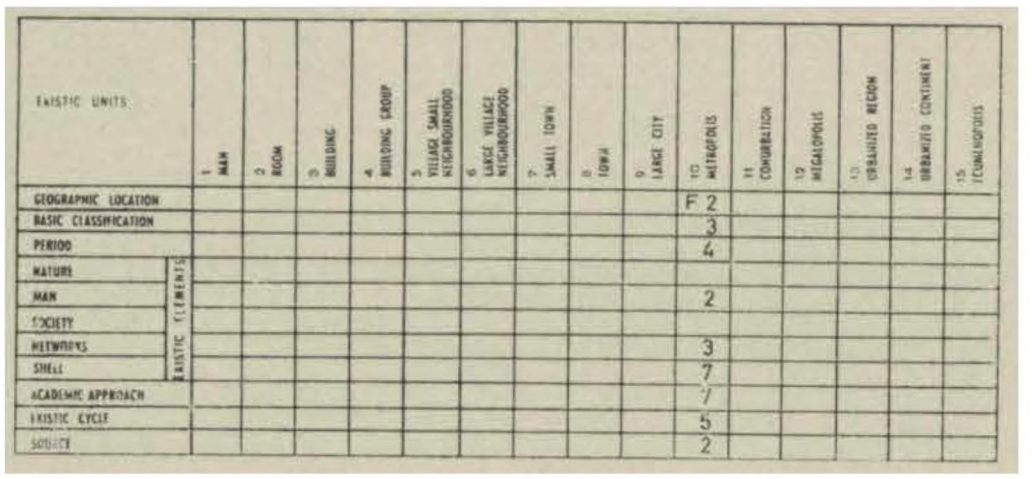


MOVEMENT SYSTEMS IN THE CITY

Fumihiko Maki

This study is the outcome of ideas and projects developed in the Urban Design Studio, Harvard University, during the academic year of 1963-64. Many promising ideas flourish in the studio courses—some bold, some even esoteric—but often they are left without maturation or a real urban context. This is mainly due to the limitations of time and circumstances set by the curriculum itself. In an effort to overcome this situation, a special task force of faculty members and students was formed in 1965 to work experimentally on carrying further some of the ideas developed the previous year in connection with an urban movement and joint system under the leadership of Professor Fumihiko Maki. The students principally concerned were Mario Corea, Seiichi Endo, Eduardo Lozano, Gustavo Munizaga and Jan Wampler. This abstract is taken from a pamphlet «Movement Systems in the City», published by the Graduate School of Design, Harvard University, 1965.

Open-ended Systems

An open-ended system is one composed of several subsystems which can each be expanded or contracted with a minimum of disturbance to the others. In other words, each subsystem is able to maintain its identity and longevity within the whole, while at the same time, it is constantly in dynamic contact with the others. The ideal system would permit the greatest efficiency and flexibility with the smallest organizational structure. Two basic operations are necessary to set up an optimum control mechanism. The first is to select proper independent subsystems; the second to provide physical joints at critical points of intersection designed to give them optimum interdependency.

The advantage of an open-ended system over a closed hierarchical system in structuring a complex physical environment is that it allows for greater flexibility and adaptability. In terms of movement, an open-ended system offers multiple choices of paths between given points, while a closed system usually provides no alternatives.

Model of an Open-ended System

A linear model of an open-ended system may be used to illustrate some of its principles though not as a literal explanation of how it works. This generalized system can be applied to habitation patterns, institutional organizations, transportation networks, and so on. It is therefore described briefly in non-specific terms (Fig. 1). The nodes or joints dispersed throughout the system can be interpreted as concentrations or critical points of varying magnitude or importance; they indicate a place of activity.

The linear members of the model represent either various types of subsystems (communication, mechanical, circulation, etc.) or their relative magnitudes (or both). Subsystem configurations may be selected and examined independently from each other, but when integrated—as in reality they must be—junctures occur between. It is at these junctures (interchanges, joints) that nodes appear and activity is naturally generated. The open-ended system becomes a structure of integrated systems and their joint nodes. It is not so much a «new system» as a clarifying tool to gain understanding of our living framework as it is with its generating potential. It is this that differentiates it from, for example, a hierarchical system (Fig. 2). While a hierarchical system offers clearly defined routes to and from given places, it cannot logically offer alternative routes, which present no problems to an open-ended system. Also, while a hierarchical system places elements in careful relationship to each other, it can make little provision for their relative change—immediate or gradual. The flexibility inherent in an open-ended system gives great freedom for such changes. Growth, shrinkage, addition or removal may all occur without disruption of the whole because no part is held rigid by another. However, although the open-ended system cannot be termed a hierarchy, it does maintain hierarchical relationships of its subsystems. The smallest branch can only be connected to the next larger and a node must mediate between the two. In principle, the route from minor subsystems to major ones must pass through a series of increasingly higher grade subsystems and their connecting nodes, though a few exceptions of this process need not vitiate the validity of the whole.

Node Development Structure—How it organizes the city

A nodal development process starts with general urban dispersion of a number of specific elements. These elements may be people, habitations, stores, offices, etc. Certain units appear to have inherent characteristics that compel or encourage them to form conglomerates that respond to their specific needs or functions (it is not just a simple desire for «togetherness» that draws similar enterprises or members of a similar socio-economic stratum to a given place). The dynamics of the functioning city establish relationships between the various nodes, and these must be reflected in the city's movement systems.

Deductive reasoning methods of considerable sophistication have disclosed many of the determining factors which have created the existing nodes in a given city and brought about its present form. Yet, as City Planners and Urban Designers, our understanding and abilities to manipulate the numerous variables of the city's «complex organization» are still quite crude. Great face-lifting efforts within parts of our cities have often achieved very little. Experience is showing how highly integrated and interdependent is the functional structure of the entire city. Planning the city to handle present and future anticipated needs can only start from understanding its variables: or subsystems. These subsystems can then be integrated into an overall conceptual system, which we describe as an open-ended system.

As stated earlier, a fundamental characteristic of an open-ended system is that it is the sum of its separate parts; each of which may be individually identified and manipulated to the benefit of the overall system. The point, or node, development structure is the subsystem which we have chosen to study. We early recognized that each node serves as a focus (or activity concentration) for a larger area. The nature of a node is determined by the characteristics of its larger area and, in its turn, it may serve to define this area. Node connectors (or paths) also establish area definition and linkage. The diagram (Fig. 3) shows some examples of nodes and node connectors

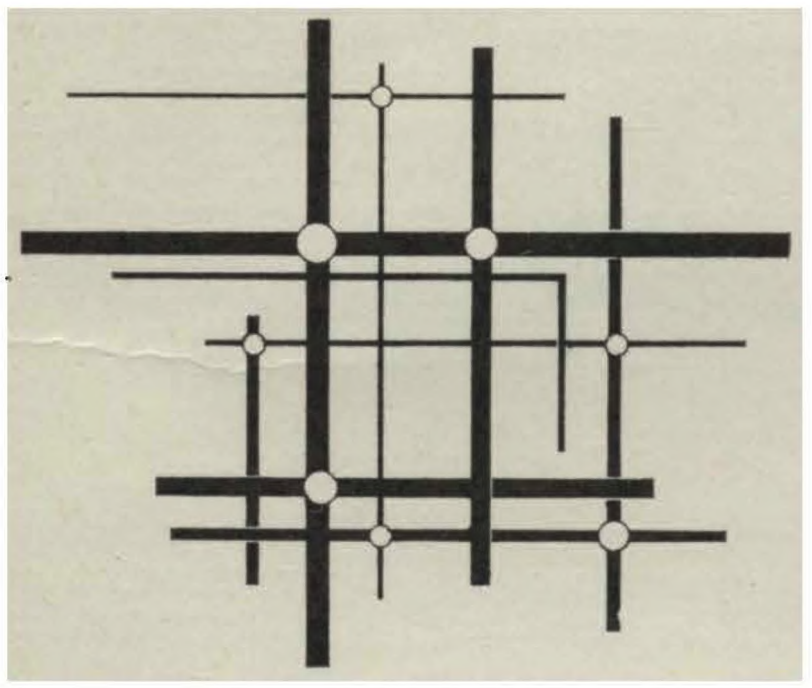


Fig. 1. Open-ended system

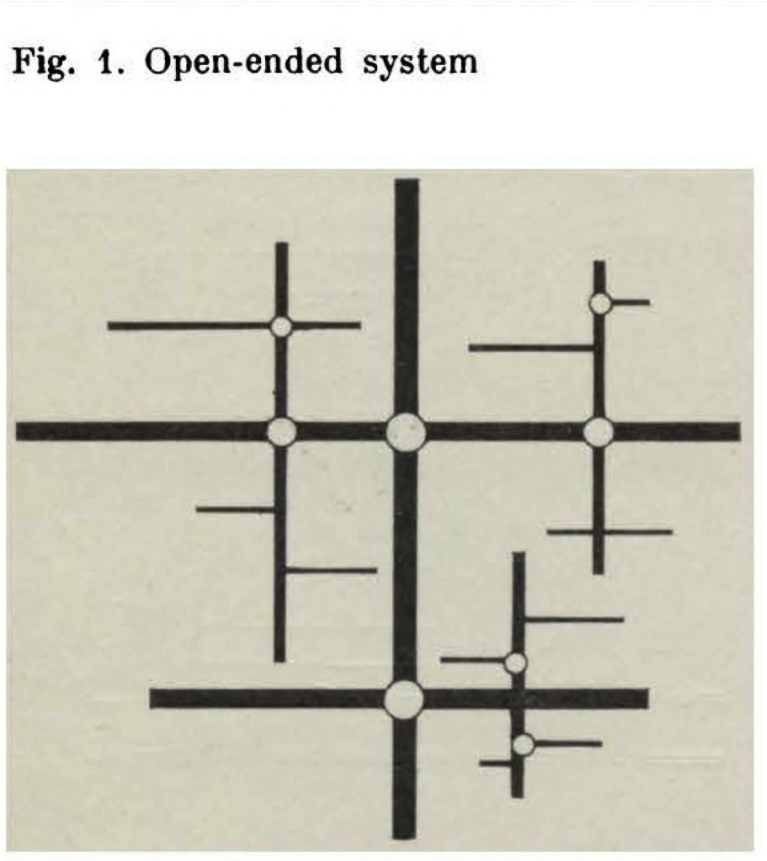


Fig. 2. Closed-in hierarchical system

Fig. 3. Node connections

to illustrate how this process may be observed in existing cities, and purposefully used to work out a more intelligible and stimulating urban environment.

Movement Systems and Joints—Why they are important to the city

The changes in cities that have occurred in the last fifty years have been primarily related to movement. Our civilization is one of mobility, and the idea of a stable place has become almost lost. Today the city must act in two contradictory ways: first as a highly efficient machine for movement, and second, as a convenient meeting place for human social activities: work, recreation, information, etc.

1. A transportation network, properly integrated with land use development and activity patterns, is the most decisive organizer of the physical structure of the city. Therefore, although all activity nodes do not exist in locations of equal vitality, the joints of the movement system must relate conveniently to strategic positions within the total network of city life.
2. Although a communication network may not necessarily be architecturally visible, the activities stimulated by it create powerful architectural events, controllable by the urban designer.
3. The creation of imaginatively designed and strategically located public nodes (city rooms) is vital for the life of the city. Enclosed central nodes—warm in winter, cool in summer, protected from wind—may enable many places to regain public attraction and confidence and become focal points for new activities and new surrounding development (Fig.4). Such enclosed public places could include shopping malls, plazas, sidewalks and arcades, and transportation terminals. It is in such places that traditional city life may redevelop: meeting friends and exchanging gossip, eating and shopping, etc. It is suggested that such covered nodes should be built largely by public funds, thus enabling their control and integration to be more predictable than if left to private development and ownership.

Movement Systems

The advent of a new transportation system and its accompanying facilities would certainly create new nodes and modifications of the old ones. For example, the railway station, which used to be a dominant gateway to and from the city, has now been superceded by the air terminal. What should be the expression of the new gateway—what should become the role of the old one? Rather than speculate on innovations of the city of the future, we have limited ourselves to the commonly acceptable and probable means of transportation within the next 15 years, and to the problems that many cities face in common today: decline of mass transit, increasing pressure of the freeway system, disintegration of visual structure, voids in human activities and accompanying social and economic problems. We intend to suggest a design framework for a movement system in which a series of related architectural and urban design actions could be structured and interact with the general planning framework.

Selecting a Set of Movement Systems

The movement systems which most profoundly affect the dynamics of the city organization are the automobile, mass transit, and the pedestrian.

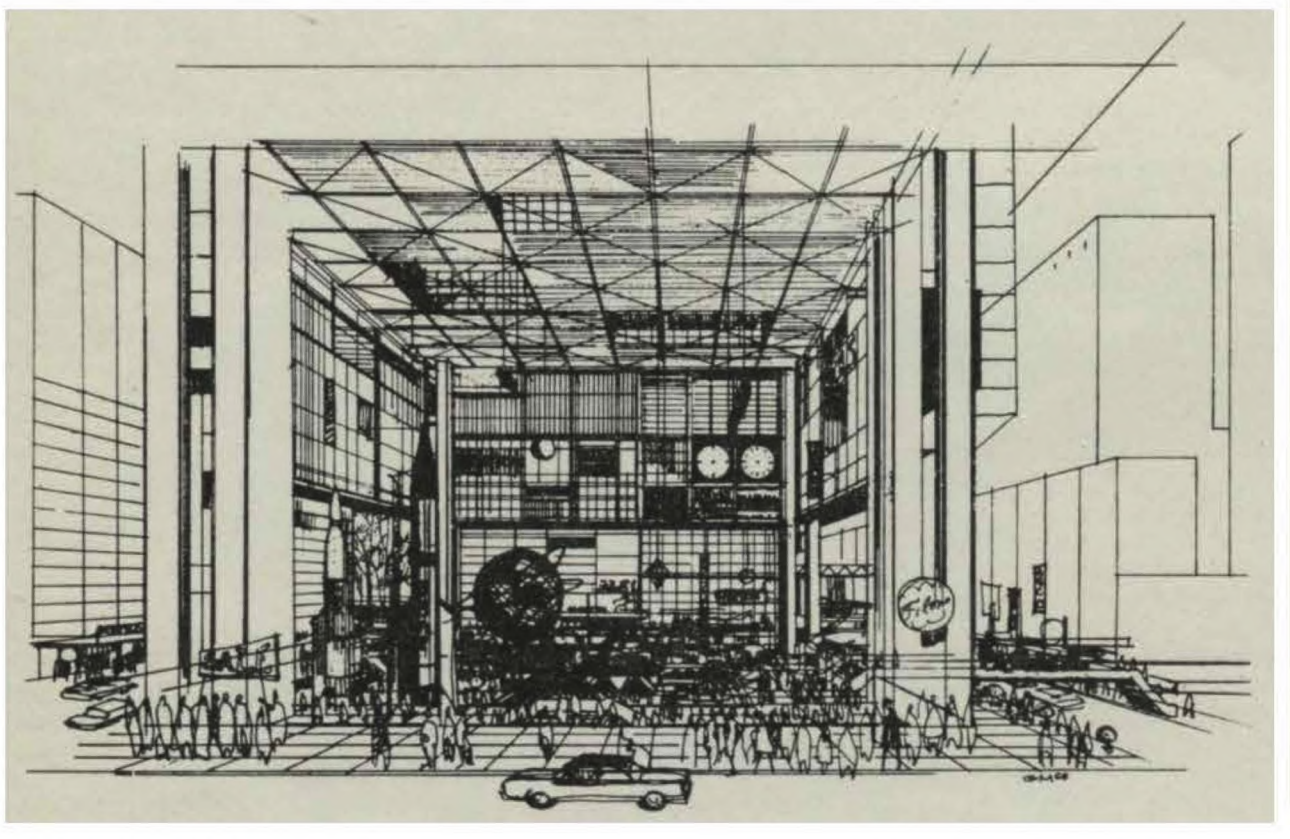


Fig. 4a. City room

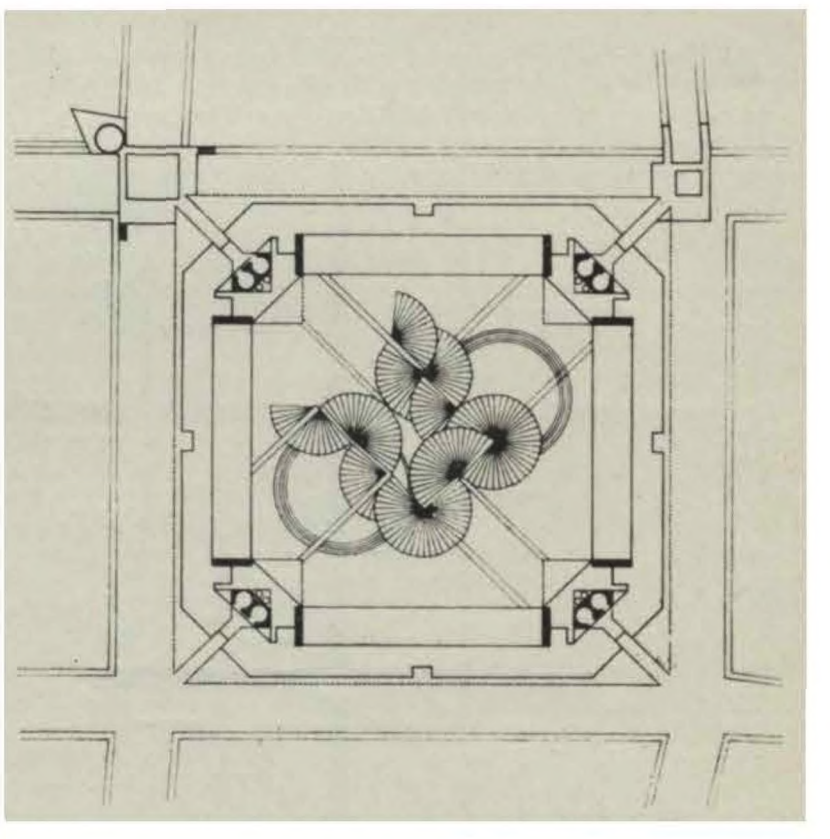


Fig. 4b. Plan pedestrian level

Expressways encircle and penetrate the metropolitan area in an ever increasing number; cars pouring into the core cripple and clog movement there. Public transportation systems—busses, railways, and subways—interconnect parts of the metropolitan area, concentrating at the core and other critical points. Pedestrian ways, including parks, malls, plazas, sidewalks, etc., weave a continuous pattern over the entire city and bring people to their final destinations. Today these systems are generally unrelated to each other and frequently they give an impression of chaos. This chaos refers «not to the lack of structure, but to the difficulty of perceiving it; and the problem is not one of restructuring but one of making understanding easier. A person moving through a city must be given visual clues and explanations of where he is and where he is going, of what these places are, and how they are related to each other» (Kevin Lynch). Our proposals include the utilization of existing transportation systems, their extension where required, and the strengthening of certain critical points. The intent is to allow development of places with inherent activity potential and also to make the city framework ccmprehensible. Metropolitan areas today tend to cause three basic zones to develop, each with characteristic transportation requirements.

1. The inner core (central city) where major regional activities are concentrated (administrative, financial, commercial, business and cultural) together with high-to-medium density residential districts. Here mass transit systems are and should be the major means of movement.
2. Inner suburban areas where medium-to-low density housing predominates with local nodes of shopping institutions and industries. Here automobiles begin to supersede mass transit systems as the primary means of movement.
3. Outer suburbs interspersed with old local town centers, new shopping centers, large industrial developments and some agricultural estates. Automobiles predominate and only an express bus system would represent a more logical means of movement.

Under these conditions we propose an optimum combination of mass transit and automobiles as the best solution for metropolitan areas for at least the next fifteen years, assuming no significant change in mode of living or of movement.

Transportation Exchange

A transportation exchange is a nodal joint where a large parking facility is combined with a mass transit station to encourage convenient and pleasant transfer from the expressway to the mass-transit system. In Figure 5, the large parking plaza accommodates up to 3,000 cars and is directly

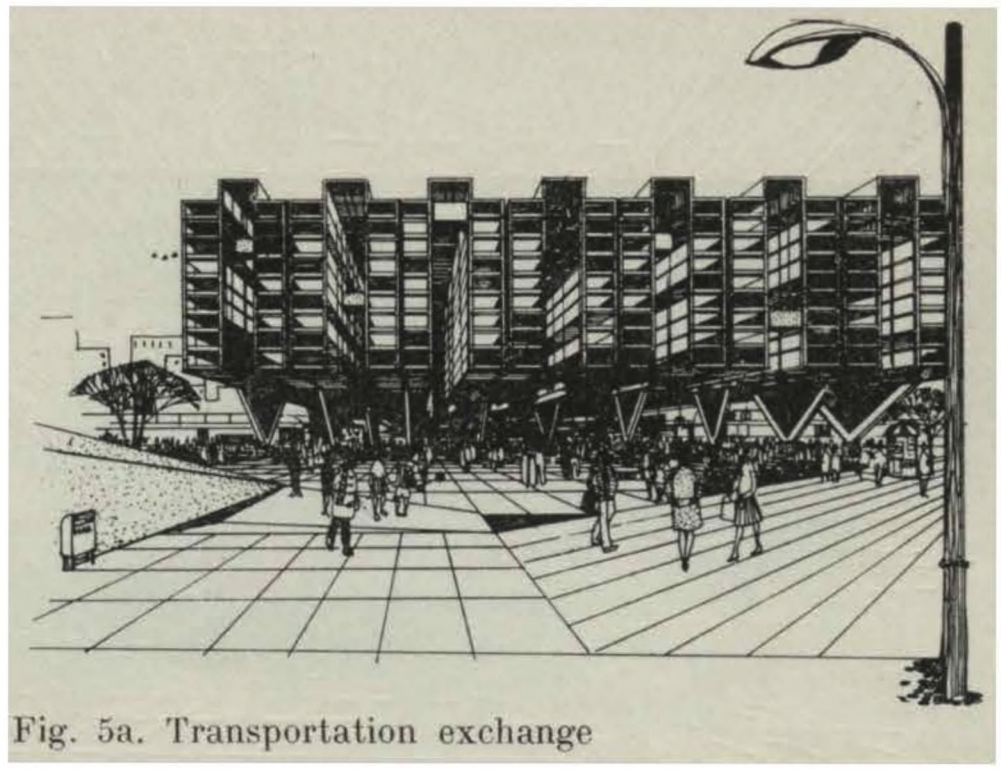


Fig. 5a. Transportation exchange

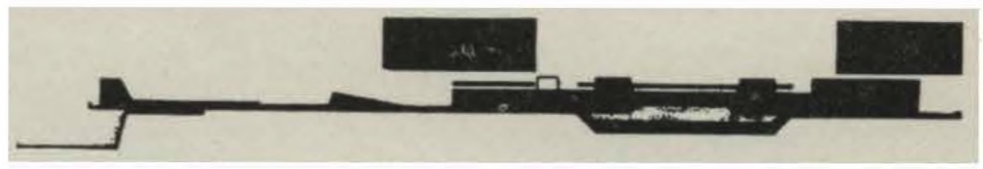


Fig. 5b. Section through a transportation exchange

connected to an expressway, with only secondary access to the adjacent local streets. As this is an exchange point, through automobile movement is discouraged. By placing transportation exchanges around the periphery of the central city, one can expect to cut down the ever increasing pressure of automobiles upon downtown street systems. These exchanges would become visible, symbolic gateways for all driving to the city on the expressway system.

The parking operation is handled mechanically after the motorists have left their cars at the plaza level. It is estimated that 10 elevators, each carrying two cars at once, will meet the rush-hour demands. From the plaza level the motorists descend to the transit station by elevators and escalators. The space between the plaza and the station can be used for shopping, amusement or even offices.

Because of its location point it is expected that such transportation exchanges will boost surrounding development—such as high density housing. Thus a constellation of such transportation exchanges would provide not only efficient exchange between different movement systems, but also contribute to the enrichment of the collective urban life.

The City Corridor

The city corridor is a pedestrian path connecting two or more nodal points. It therefore has two functions:

1. to direct people from one place to another.
2. to provide an awareness of this journey.

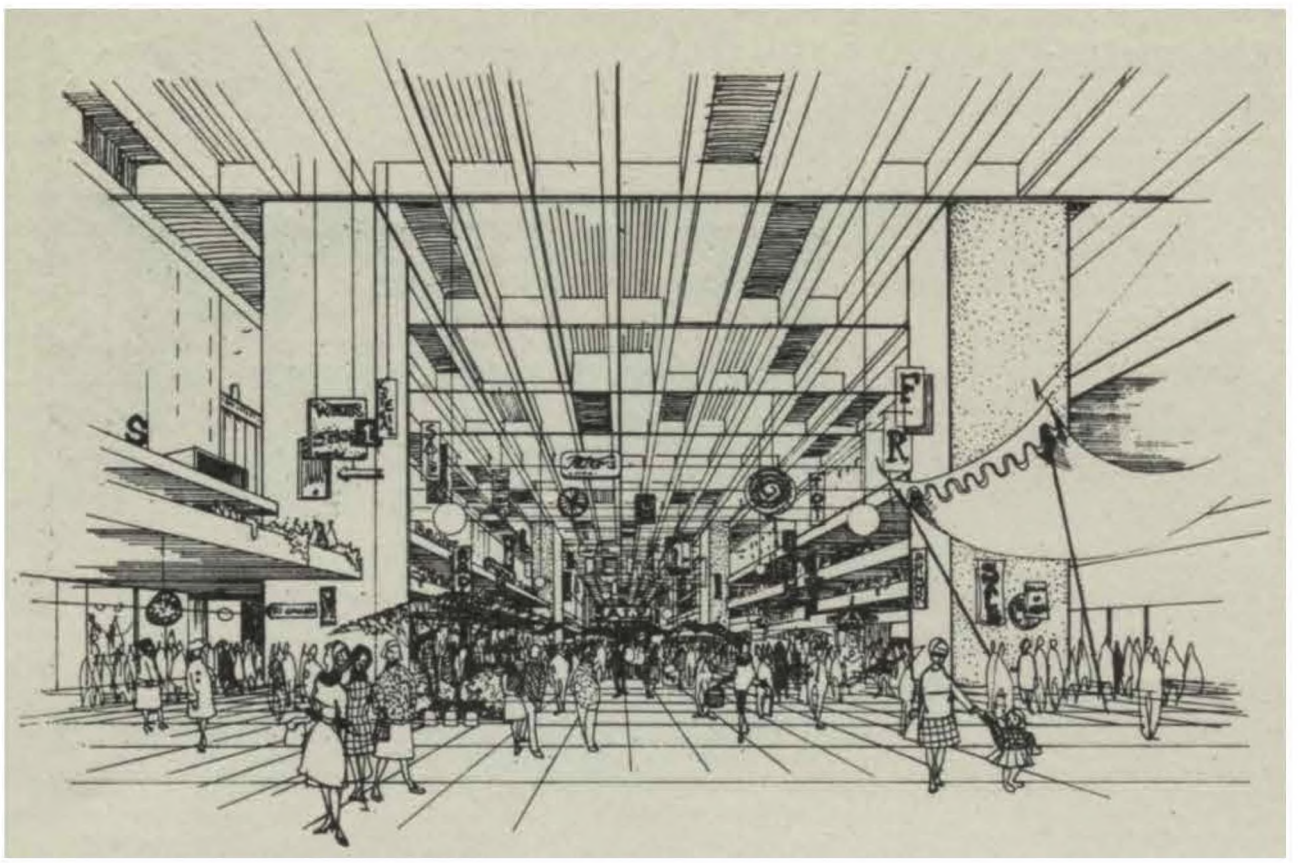
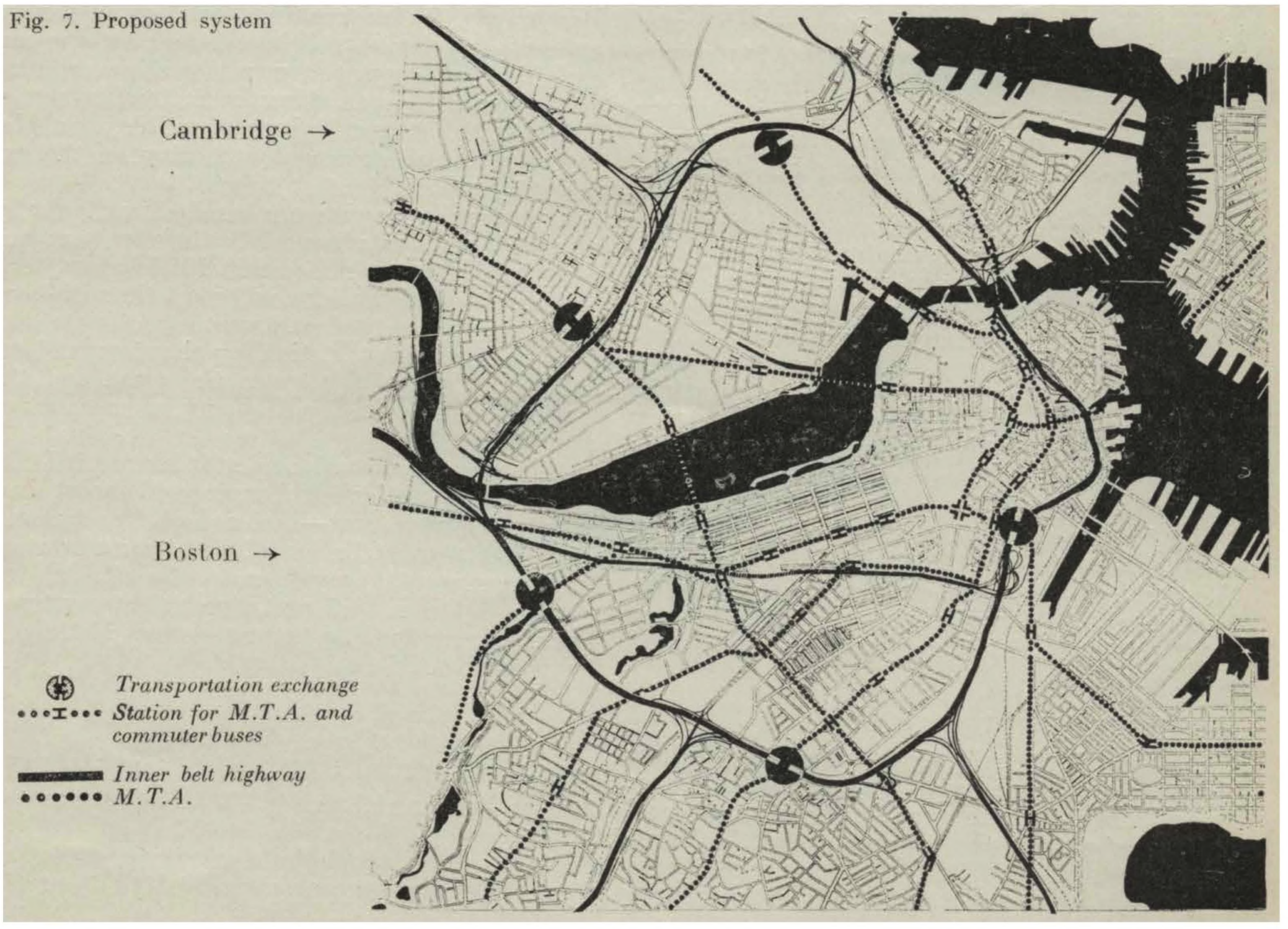


Fig. 6. Covered city corridor

Fig. 7. Proposed system



What differentiates the path from the nodes is the unfolding of a sequence of varied experience. Indeed the city corridor should be a stream running through the matrix of the city texture, absorbing, stimulating and diverting various kinds of activity flow. The city corridor shown in Figure 6 gives protection from rain and wind and provides conditioned air throughout the year. There can be two kinds of city corridors: The first, formed from existing streets between rows of buildings, when only the pedestrian level of the buildings will be incorporated into the corridor, making a maze-like pedestrian mall; the second, an independent structure, with shopping, amusement, and other pertinent functions within its own structure. In one form, this could be expressed in terms of a megastructure.

Movement Systems of Boston

In order to test our concepts we chose the central area of Boston, within the proposed inner belt expressway system. This was chosen because it was an area with which we are familiar, and because it presents the problems we had identified as common to many cities of today: steady decline of mass transit, increasing pressure on and by the freeway system, disintegration of visual structure, and voids in human activities with the accompanying social problems and pressures. However, the aim of this study was not to solve the individual problems of Boston, but to demonstrate the general applicability of our ideas.

Metropolitan Transit Authority

Our proposals for the Boston Metropolitan Transit Authority are threefold (Fig. 7):

1. The extension of two existing radial MTA subway lines along unused railroad beds.
2. The re-routing of two existing radial subway lines to serve both sides of the central area. We propose that the stations of both lines be paired. This would create short pedestrian axes across the core, and enable easy transfer from one line to the other.
3. The introduction of a partial circumferential line connecting the Cambridge area to southern districts of Boston. This line would also serve the end of the core presently under development.

Transportation Exchange

Six transportation exchanges (as described earlier) would be located along Boston's inner belt expressway, where it intersects the subway lines, each exchange accommodating 2500-4000 automobiles.

Commuter Bus and Microbus

Commuter buses would serve outlying areas of the city, in gaps left by the subway system, during the morning and evening rush hours. They would run non-stop from designated residential areas to core points. One lane of the expressways would be monopolized by them, enabling a speedy transit.

Microbuses would weave a fine network within the central Boston area between parking nodes, bus stops, transportation exchanges, and points of main activity. To maximize their use, they would be routed by computer to the areas with the most pressing need.

Development Structure

The movement and node structure suggests numerous possible ways of development which can occur within the framework and without injury to it.

Our discussion has been concerned with only two of the important subsystems within the overall city structure—its movement and node systems. To approach a more complete understanding of the city's workings, similar discussions of other subsystems need to be coordinated. Such subsystems would include the network of historical properties and landmarks, cultural and institutional bodies, etc. We realize that until such studies have been gathered and incorporated, the study we present here must be incomplete.