OPEN SPACE: AN INFRASTRUCTURAL RESOURCE FOR QUALITY OF LIFE

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ABSTRACT: Few people would contest the notion that open space can provide positive value to the public. How valuable it is though, compared with the economic value of the developed land associated with it, is another question altogether. This research attempts to classify open spaces and to provide a framework for approximating amenity values of open spaces. It also features open space as infrastructure rather than as a land use. Through this definition it attempts to discover the economic value associated with it as an infrastructural investment rather than simply as devalued land. Additionally, it seeks to find out if a correlation exists between amenity value and quality of life. Many studies support a correlation between quality of life and economic value. It follows that if higher amenity value improves economic value, it would also improve quality of life.

In search of an economic coefficient for amenity valuation, the study will propose three separate but related GIS models. All three will feature open space as an integral component of the infrastructure. The models will classify and map the spatial structure according to land uses, utility and perceptual values. Analysis of the models will determine the potential benefits and costs of amenity valuation.

PREFACE

The purpose of this paper is to lay the foundation. To propose the research and to propose the existence of a structural quality which open spatial material affords to our environment. Future research will protract the implications of this concept into areas of study like urban sprawl, externalities, economic development and quality of life. The assessment of amenity value and the techniques used to empirically measure it must be simple and straight forward enough to be applied. Also, they must be comprehensive enough to consider the myriad of operational factors. These empirical techniques do exist, as do good examples of well managed open spatial systems. The future work of this research will be to study these systems and the techniques available for evaluating them. The objective being to derive the necessary equations for the modeling and analysis of this open spatial structure and its potential costs and benefits to our quality of life. This paper will provide a background, based on previous studies and models of the structure associated with location theory and central place. It will then associate features and attributes of open space that will place it in a context relative to these central places. It will conclude by correlating of these features and attributes to those of infrastructure in order to derive an operational significance to open space's amenity value.

INTRODUCTION

The purpose of these introductory remarks is to make several distinctions about the discussion that follows. The first is to specify that the proposed research relates primarily to the analysis of open spaces in developed settings - where human intervention is the dominant theme in the surrounding landscape whether it is rural, suburban or urban. A second distinction is that this study deals with all space that is open, irrespective of ownership or use. A third critical distinction must also be made to

clarify the structural identity of open space as opposed to the operational identity of amenity. Open space is quantifiable. Amenity is qualifiable. Open space, by itself, may or may not provide any benefit. Amenity is operationalized by the benefits and costs associated with the open spaces. Amenity value is the value in use or utility of the open space. It can be empirically measured based on functional and perceptual factors. The traditional open space myth is that more is better. The foundation that this paper seeks to lay is that the quality of open spaces (their amenity value) as a scale of measurement is far superior to quantity. Further, the research seeks to apply criteria for the definition of a range of open space values based on a framework of landscape utility and cognition. The overriding purpose then of evaluating open space in this research is to determine, through the modeling of it, amenity values that will be calculated from functional and perceptual criteria and which will approximate the associated economic value of improved amenity.

BACKGROUND

Any discussion of space relative to economics must begin by firmly associating itself with the foundational concepts initially conceived by the innovators of central place theory.
J Heinrich Von Thunnen, sometimes described as the 'father of location theory', is generally credited as the first to study the interrelationships between urban and rural areas. He devised a system of peripheral zones around a central city where the type of production occurring in the zones varied according to the distance from the city. Another theorist, A. Weber modified the whole approach when he "projected 'pure economics into a spatial context' and derived a 'theory of location systems'. He conceived the idea of an abstract space, a 'new and empty zone', settled by successive human communities . . . occupying different locations and linked by a series of vertical relationships. Weber was the first 'to consider relating theories of regionalisation and of location' and to be aware of the possibility of the spatial association of productive activities'."[12]

Two other important founders of central place theory are Walter Christaller and August Losch. "Christaller first examined empirically, the existing urban network in southern Germany and its functional relationships...he then formulated laws governing the nodality of space and the hierarchy of central places."[13] Christallers ground breaking research explored various combinations of hexagonally structured allocations of space. His three key principles theorized central places according to their functions as marketing, traffic or administrative centers. His hierarchy has been criticized, by Losch and others, as too rigid. The problem being that once one principle has been established it remains constant. This omits the inclusion of dynamic market areas and regional evolution resulting from growth. Losch's model, like Christallers, also used one highest order center, common for all other centers which were arrayed around it, the metropolis. The network of centers or mesh, also hexagonal, was formed by the spatial distribution of these lower order centers. The fineness or coarseness (texture) of the mesh, or the number of hexagons, was determined by the threshold value, exhibited in the demand curve of particular goods produced by the center.

It should be noted here that, contrary to central place analysis and location theory, the focus of this research is not on central places but the antithesis of central places. "'The Losch model covers the full range of market areas but all possible cases are not found in reality'. Geographers should take note of this lesson in methodology - and this conclusion: it is sufficient that a model should provide a theoretical framework representing the general case. There may be material that cannot be integrated into it, and a model may also define what does not yet exist or what we perhaps do not understand."[14] It is this non-integrated material that the proposed study focuses on. Actually, the view here considers the material to be more disaggregated than not-integrated. This disaggregation is

viewed as creating a newer sp tial dynamic within Weber's 'new and empty zone'. This dynamic affects the spatial material suc. that its character is modified or supplanted by that of the uses which occupy it.

Walter Isard in 1956 attempted to modify the Losch system diagrammatically by breaking away from the rigid geometry afforded by it. Whereas Losch had shown lower order centers defined by evenly sized hexagons, Isard allowed hexagon size to vary, introducing the notion that hexagon size was influenced by density of populations and by competition. Density drives competition and both increase as proximity to the highest order center increases. Lower order market centers, or hexagons, condense with proximity to the main center and expand with greater distance providing a gradation in the texture of the mesh. The non-integrated material occurs again here in terms of the fabric of the mesh itself, the outside husk of the fu tional unit. Its framework integrates the various functional units and sacrifices its own character t integrate theirs. The stuff which makes up this so called non-integrated material is, for the purpose of this study, the open space.

OPEN SPACE

To fully define open space in appropriate terms we must further define some more general types of spatial division. Some theories on the structure of spatial division have incorporated the notion of space being comprised of "static and functional units."[15] In Methods and Perspectives in Geography, J. Beaujue-Garnier describes four spatial divisions in this context. Th ee of these divisions occur in zones dominated by human activity. The interactions between the stati id functional units within these divisions and the products of those interactions are the focus of this vestigation.

In the first, "functional areas develop round a pole of economic activity or an administrative or commercial town....between the clearly-defined fragments of space is a loose fabric on which differential factors operate progressively as human societies themselves evolve. Population density is therefore a good index of local variation (relative to the pole) within this 'human division of space."[16]. For this discussion, suburban and rural contexts will approximate a backdrop for this division.

In the second division highly developed areas, "where man's presence has had a profound spatial impact....where natural features are fragmented, ...functional nodes are superimposed on the static divisions and become their fundamental characteristics. In a perfect system, not one but a whole series of functional divisions are superimposed on a static unit, permitting choice, competition, internal change and ultimately the provision of the highest order of central functions and the dimensions of the center of attraction - most commonly the urban network."[17]

The third division is "a geographic division par excellence in which all of the characteristics coincide. The physical environment provides a precise clearly-defined framework, the life and economy of the inhabitants have adapted to this environment, a major town has developed and is the market and nerve center of the whole complex."[18] Few examples of this division exist. The point is that they do exist. Most often they result from exceptional circumstances that do not seem to occur very often in reality. Therefore, they will only be addressed in this study in terms an ideal - an objective goal.

In the first of the two relevant spatial divisions the concept of open space relates to 'the loose fabric on which differential factors operate'. However, in our sense the space is much more fragmented than that of the original model proposed by Meynen and Hammerschmid in 1967. In our proposition population density can index the variation; being identified as the fabrics texture or more specifically, the mesh of the fabric. Christaller and Losch both desribed spatial constructions of

economic behavior using a geometrically consistent hexagonal mesh. Isard allowed hexagon size to vary, even to the point of departure from the geometry. In our study with the concept of open space as the mesh, uniform geometry is lost completely and the texture changes according to the intensity of human use in the spatial structure. Studying the gradation of this intensity of use texture could reveal high or low quality areas of the fabric in our proposed model if it weren't for the functions associated with the second division.

In the second relevant division, a model proposed by Berry and Pred in 1961, the correlation is similar. Open space still exemplifies the mesh but, since the functional units tend to overwhelm the static units their activities or their pattern becomes the fundamental characteristics of these divisions, the integrity of the overall fabric is compromised and much of the character of the open space mesh is engulfed by the activities which occur in association with it.

The range of open spaces that occur within these two divisions is broad. Open space which occurs can be used for some purpose or it can be unsued; tended or untended. It can be of any size, shape, or ownership. Open space can be public, in the traditional sense of a park or in another sense as a public street right-of-way, or a downtown pedestrian corridor, even in terms of the space associated with a public facility. Open spaces can be quasi-public, for example, the spaces adjacent to railroad tracks, power lines or other infrastuctural components, legally described as easements or other right-of-ways. Open spaces can occur privately on industrial properties, exhibited as vacant land. The popular view of open space regards it in association with new suburban development. Open space of this nature is generally termed 'common' area. This research will study not just common open space but all open spatial structure.

Open space, in and of itself, may or may not provide benefit. In fact, in some cases it may be detrimental. Its benefit, for our purposes, is determined by its condition and the activities which take place on it. In defining the many different kinds of open spaces which occur, the idea should be reinforced that we wish to study the disaggregated backdrop of the static units, or in other words, the left over spaces of a collection of various land uses . These left over spaces function differently relative to the activities they are associated with and to the spatial divisions in which they occur. Open spaces in the first division can retain their own integrity and are more easily defined. Open space in the second division becomes homogenized within its respective functional units and loses its identity. In studying these spaces we find that "definition of spatial homogeneity and measurement of relationships between flows and the function of centrality must also derive a classification of regional types and determine the laws of evolution and development which transform them."[19] Previous classifications relate to the central activities. This one will address the spatial by-product of the activities. In an attempt to calculate measurable indices, to identify these significant relationships and derive a typology, the following list of landuse types will be used as an organizational framework for the structure of open space.

Landuse Classifications for Open Space Type Designation

rural-conservation-agriculture district
- flood hazard districts

residence districts
- large lot zoning
- detached and semidetached single family zoning
- planned apartment districts
- mixed use office /apartment

institutional districts
professional districts
commercial districts
downtown development districts
shopping center districts
limited industrial districts
limited office districts
planned industrial park districts
hotel office district

The different open spaces that occur in each of these land use types can be evaluated in many ways. They can be rated functionally, in a context of their operational utility. They can be rated, as previously eluded to, according to population density or intensity of use, as in people per open space unit. A framework of visual quality objectives and visual absorption capability can be used to derive values. The rating can be based on their intrinsic benefits to society, whether they are negative, neutral or positive extensions of the uses they are associated with. Open spaces can be rated economically, based on the property value of the land they occur on. They can also be distinguished by various descriptive factors such as form, line, color, texture, variety, exposure, harmony and contrast.

Quality can be evaluated in terms of landscape perception which is based on the informational elements of coherence, complexity, legibility and mystery. Other systems of evaluation exist as well. No matter what system is used, this evaluative process represents a departure from purely pragmatic quantification and classification. The current literature review suggests that a combination of evaluative techniques will be required to fully analyze the complexity of open space values. Further discussions will detail the specific, empirically based value systems to be used and reference their authors. At this point, however, it remains necessary to further specify the structural nature of open space that gives it real significance.

INFRASTRUCTURE

Many classification schemes would consider open space to be an additional land use type. Open space however, in this classification it is not a land use per se. Rather, it is a part and parcel of every use of land. Of course there are some exceptional open space systems that are of such high amenity value that they have been preserved and maintained as their own land uses. This kind of open space does occur in both of our relevant spatial divisions, specifically in terms of parkland or natural preserves. It is not included in this land use typology though, because it generally retains its own character. For this discussion then, the open spaces occur as the dissaggregated material that is integrating the static and functional units, as previously described, the mesh. In our landscape fabric of spatial units, we consider open space as the mesh binding together the patchwork cloth of the individual, integrated activities. It provides transitions between the activities, within and around all functional units. Is open space infrastructure? In the sense described here it is. The ubiquitous nature of open space and the various types and functions of it which occur in association with every potential land use suggest that its operation resembles, much more, a network than a group of singularly operating units. Since the specification of open space described here does give it a network-like quality we will assume for the moment that it does provide a structure.

It is not merely the existence of open space that gives it any value, it is the quality of the amenity provided by it. Infrastructure, of any kind, is useless if it does not function. If networks are severed or blocked or unstable then the supportive function intended never occurs and they are considered to have collapsed. Again, like much of our urban infrastructure, this is the current state of our open space structure.

Traditional infrastructure must be managed. To this end it is placed under the purview of some economic or administrative body. These bodies can be political authorities, management authorities or utility companies, what is relevant here is that they are organizations that own or interface with land. Their infrastructure, like open space, also becomes part and parcel of the land uses that it supports. Their interests lie in providing utility. This utility occurs as electric, water, sewer, gas, phone, cable, streets, and sanitation services. Some utilities are land uses themselves, just as some open spaces are. A few examples include things like airports, port authorities or rail yards. The basis for evaluating open space as infrastructure is founded on the assumption that it, like infrastructure, possesses utility and that its utility can be measured empirically.

Traditional infrastructure is also a community investment. New infrastructure is generally created as a result of new development. The cost of most new infrastructure is initially borne by the real estate developer who, in turn, passes it on to the consumer. The new residents of a single-family, detached housing development may not realize they've paid for part of the whole developments' pipes and wires but they have. They do however, realize they've paid for the "common" open space that is often included these days. They can see it right there in front of them. Not only did they paid for it, they continue to pay for its maintenance through their home owner's association dues. They pay these dues, often, much to their disgruntlement. Up until recently, the value of open space as a potential by-product of development production was not even recognized. It has always been there though, in one form or another. In the form of its utility to the owner or in the form of its utility to the local populace who consciously or subconsciously have relied on it.

In its traditional form, residential open space had, for the most part, occurred under private ownership as large yards on large lots. Although this development style provides the illusion of openness, this "large lot" zoning of the landscape has been a primary cause of the urban sprawl which has inflicted many metropolitan regions. These large yards, by our definition do constitute open space. It is this kind of disaggregated open space however, which contributes to the compromise of the fabric by reducing the character of the space to that of the activity taking place within it. It is not only large lot zoning which contributes to this compromise. It is any activity which operates as if the spatial structure it operates within does not exist.

What it really boils down to is just a matter of how we view the responsibilities and rewards associated with ownership and maintenance of the land. Many land users pay a great deal of attention to the amenity value afforded by their properties. They maintain it for their own utility and that of the community at large, realizing of course that, what benefits the community, inevitably returns to benefit them. However, since we do not all share the same convictions or understanding, perhaps open space structure should be managed professionally and maintained for its utility as community support structure or as corporate infrastructure.

This is not to say that space which is simply open should be considered common property. Though it could bear a resemblance to the "'opportunity of the commons' in which government creates economic incentives that promise increased profits to a company that decreases its pollution output."[20] The ownership of open space in this sense has nothing to do with it structural attributes. Common property rights would be the worst context to place this kind of space in. The most important rights to consider here are rights to amenity, for the property itself. Rights of the owner to

profit from its amenity improvement as well as the rights of the community to not have its value affected by potential disamenity caused by individual negligence. "Common property resources cannot be managed by a single individual, nation, or corporation, because without some form of governmental or international regulation to allocate resources among users, individuals have little incentive to preserve or protect resources for future generations."[21] An example of governmental regulation of common property at the national level is the clean air act. As an amendment, the EPA established its PSD (prevention of significant deterioration) policy, "which effectively limits the extent to which clean air can be degraded by managing economic growth in various regions (National Research Council, 1981)."[22] Clearly this kind of an approach would not function to meet the demands of a dynamic system like open space. People and their activities do not occupy air space, they occupy open space. Not to mention the fact that legislating the bits and pieces of the open landscape is not quite as simple as legislating air quality. Still the idea of a user's responsibility for preventing significant deterioration of the spaces they occupy or use can have some operational significance.

The real point is that the infrastructure which exists now has been created as a by-product of development production. Once it has been created, it is viewed as an investment, it is managed and maintained. Open space is created in the same way as infrastructure. It should, therefore, be managed and maintained in the same way, as an investment. In order for this to happen, for it to retain and improve its value, it must be able to provide equity to itself and to its owner.

Another feature of infrastructure is that it can be represented as a legal entity, it is corporate. "The world of the lawyer is peopled with inanimate right-holders: trusts, corporations, joint ventures, municipalities, Subchapter R partnerships, and nation states, to mention just a few."[23] Christopher D. Stone, Professor of Law at the University of Southern California, argued this belief eloquently and convincingly in his essay, Should Trees Have Standing? Toward Legal Rights for Natural Objects. In it he wrote that: "It is not inevitable, nor is it wise, that natural objects should have no rights to seek redress in their own behalf. It is no answer to say that streams and forests cannot have standing because streams and forests cannot speak. Corporations cannot speak either; nor can states, estates, infants, incompetents, municipalities, or universities. Lawyers speak for them. One ought, I think, to handle the legal problems of natural objects as one does the problem of legal incompetents . . . those concerned with his well-being make such a showing to the court, and someone is designated by the court with the authority to manage the incompetent's affairs. The 'guardian' then represents the incompetent in his legal affairs."[24]

This transference of legal rights does not just relate to representative concepts of people or of groups of people. A splendid example that Stone points to in this regard is the case of "United States v. Cargo of the Brig Malek Adhel"[25] In this case, a ship that had been siezed and used by pirates, without the knowledge of the owners, was held accountable for the crimes that were committed "by it". The "offending vessel" was condemned and sold at the owners protest. The idea of legal rights for infrastructure parallels more closely a corporate rights example than it does this physical ship example. However, the case is pertinent to our study since it exemplifies this transference of rights to an inanimate object. To take it one step further, let us suppose the owners of the ship, prior to its offending voyage, had just completed a major overhaul of the ship; ... The money that they spent for the required maintenance, legislatively would have become, in effect, an investment inevitably belonging to the ship not necessarily to the owners. Indeed the owners may have had to make the overhaul to make the ship seaworthy just to pass an inspection permitting its use. We require minimum standards of quality to grant the privilege of operating such vessels. We do this for other kinds of machinery as well: cars, farm equipment, industrial equipment, factories, school systems,

infrastructure . . . why not for quality of the spaces that we all share. By granting rights to open space as corporate interest or guardianship we can begin to associate its right to retain or improve its own value. Like infrastructure its function as support structure is far too important to avoid preserving its quality by at least granting the same sort of corporate legal rights.

The distinction has been made, between open space as a land use and open spaces that are integral parts of every land use. The space we are dealing with here is part of every use of land, part of every activity that takes place on the land. It is the network or the mesh which integrates and binds individual activities together. This kind of space can be managed or not managed. Its utility can be appreciated or ignored. It, like infrastructure is created as a result of development production; it functions as a support structure for the amenity value of all developed activities. The community can consider their own investment in it or they can simply view it as the responsibility of someone else. Once it is recognized as an investment and its true economic value identified, it will be managed and maintained as an investment. As an investment, the corporate bodies or amenity authorities, who would maintain it would do so because of their responsibility to the corporate interest of keeping its value high. Value that would have to be based on its quality as support structure rather than on any market value associated with it. This is exactly why its amenity value is not common property. If we view it as common property and think of it in terms of a quantified land parcel, its value becomes zero. A corporate interest has value. It is managed in order to improve its own value. That value is not legally associated with any individual, it is associated with the corporation. It is not then open space as property that is being valued. It is the amenity value of open space. It is the value that it has of its own accord, legally, as a corporate interest.

The conglomeration of attributes that comprise open space, its occurrence in association with all other activities, in all manner of land use types; The functional identity of open space, as a support structure, providing the amenity value of the corporate interest; In addition to its corporate right to maintaining a high value of that interest; All of these features serve to distinguish this kind of space from that of the integrated material which has traditionally been the focus central place study. This is the space associated with the mesh, the matrix of the fabric that occurs on our landscape to integrate all of the activity functions of life. As such, then, this amalgam will be defined from here on as the open structure.

The issue which remains to be resolved, obviously rests in identifying the economic value of open structure. The purpose of this paper has been to lay the foundation. To establish the focus of the research to be performed and to propose the existence of this structural quality which the open spatial material affords to our environment. More background study remains in order to further protract the implications of this concept into areas of study like urban sprawl, externalities, economic development and quality of life. The assessment of amenity value and the techniques used to empirically measure it must be simple and straight forward enough to be applied and, at the same time be comprehensive enough to consider the myriad of operational factors. These empirical techniques do exist, as do good examples of well managed open structure systems. The future work of this research will be to study these systems and the techniques available for evaluating them and to derive the necessary equations for the modeling and analysis of this open structure and its potential benefits to our quality of life.