A STUDY
OF SOME VISUAL CONSIDERATIONS
OF THE GRIDIRON PLAN
FOR RESIDENTIAL SUB-DIVISION

by

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submitted in partial fulfillment
of requirements for the degree
master of architecture

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institute
of
technology

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DISCLAIMER

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ABSTRACT OF THESIS


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The criticism, with respect to visual considerations, that has been directed toward gridiron planning for residential subdivision on sites of level terrain, and the use of standardized units in such large scale areas is questioned as a original premise.

A historical analysis of gridiron planning indicates that the grid plan, was the first and most widely used form of comprehensive planning. Its use was most prevalent and successful on level terrain. It is a simple and direct way for man to express his natural tendency to create order, in his urban environment. Its use can be correlated with towns which have been comprehensively planned and executed over a short time span, and the Gridiron is more flexible and adaptable than is generally recognized.

Order is a fundamental visual consideration. Methods in achieving order in large scale planning must be determined by the size of the composition and the ability to maintain a sense of direction. On level terrain a geometric order rather than an "organic order" will logically evolve. Planning with a Grid is one method of expressing a geometric order.

The criticism that Gridirons are inherently monotonous is not well founded if the problem is attacked with a knowledge of fundamental principles of composition. Nor is the use of standardized housing units on a large scale an unsolvable visual problem if the same principles are applied with ingenuity.

Unit spaces, their individual qualities and quantity and their compositional interrelationships are the most important and all-inclusive
design element in the residential townscape. A solution to the problem of the prevalent monotony of gridiron planning and the use of the standardized housing units lies in considering them as space enclosing elements which are composed in a way that they will evoke visual and emotional responses.

In support and conclusion of the thesis that neither the grid nor the standardized housing unit present incurable visual problems, a series of design studies illustrate how basic visual principles can be practically applied in a "neighborhood precinct" and a hypothetical subdivision for standardized units on level terrain as it would concern a speculative or commercial builder.
I wish to express appreciation and gratitude to those members of the faculty who gave valuable assistance, wise council, and helpful criticism, and to my fellow classmates and various students in the Department of Planning who participated in illuminating discussions.

A special acknowledgment is due the following:

Prof. Lawrence B. Anderson

Prof. Kevin Lynch

Miss Shillaber
Prof. Herbert L. Beckwith, Chairman of
Committee on Graduate Theses
Department of Architecture
Massachusetts Institute of Technology
Cambridge, Massachusetts

Dear Prof. Beckwith:

I herewith submit the following proposals for a thesis entitled "A Study of Some Visual Considerations of the Gridiron Plan for Residential Subdivision".

The gridiron scheme for planning our cities has been viciously attacked by many contemporary planners. It would appear however, after a preliminary analysis that many of its alleged evils are merely a result of problems which have not been seriously dealt with. This proposal for a thesis would seek to offer a very possible solution to some of the professed inherent problems of the gridiron—particularly in the residential sub-division, since it is in this area that criticism has been voiced most vociferously. It seems apparent that a comprehensive study of the many facets of sociology, economics, and technology in the design of a residential sub-division would be impossible within the period of time allotted for this work. Furthermore, any attempt to undertake such a program of study in three months would result in a superficial solution to any or all of the considerations undertaken. Therefore, the proposal is made to study intensively some of the visual considerations in the design of a residential subdivision—not to the exclusion of economic, social, and technological factors, but rather, making a series of very plausible assumptions when and where it seems desirable and necessary. Furthermore, it is felt that concentrated study on one facet of a problem does not necessarily result in a superficial solution, but that it has definite value in isolating the problems for
a comprehensive consideration of them which in many instances is not possible if problems of the whole framework are given equal weight.

To limit and define the area of study more specifically the proposal is made to work with a hypothetical gridiron which might apply to a typical Midwest plains city—and to attack the visual problems of the "Anonymous" or mass produced house as they exist in such a city.

One living in the Midwest cannot fail to be forcibly impressed by the lack of a design philosophy which should be effective in resolving some of their large scale design problems. Existing proto-types range from the deadly small city blocks determined by the straight streets of the typical gridiron with their boxy and monotonous houses and street spaces, to the meandering and confusing street pattern of the "organic" approach which is used on rough terrain. When applied to flat terrain one might be inclined to call the latter approach a cliche. At any rate a definite and provocative problem does seem to exist.

The following outline represents a proposed method of study:

Part I Preparatory Work

I Historical analysis and survey
   a. Analysis of the gridiron complex of cities of the past
   b. Investigate views and philosophies of various planners and historians
   c. Study of isolated examples of smaller scale spaces which are interesting visually
   d. A summary evaluation of visual principles in three dimensional space design as indicated by examples studied.

II Formulate some principles of design which have a contemporary application toward contributing to a more healthy visual environment.
   a. An enlargement on work done the last two weeks of the Fall term
Part II  Execution of a Design

I  The residential complex
A study of a limited nature but which is sufficient to illustrate a feasible method for providing a frame of reference for the more detailed work described below.

II  The neighborhood unit
A detailed study of an area the size of which might range from 1/4 to 1 mile square, depending on factors considered in the study of the residential complex as described above. It is proposed to design this area for sub-division to be occupied by the anonymous house with major emphasis on the visual aspects of a space of this size. It is anticipated that considerations of circulation will receive rather intensive study as compared with social, economic, and other technical considerations because of its close association with the organization of visual spaces.

III  The anonymous house
Through the recent NAHB-Arch, Forum competition may have become aware of the important role the anonymous house will play in our future housing program and our future city environment. It would seem however, that important as the design of the individual unit is in itself, much needs to be learned in the way they relate to each other as parts of a large visual composition. It is proposed to study existing proto-types in an effort to determine what characteristics of the individual structures are important in the visual integration of this larger complex. The problem would appear to be one of finding one or two basic units which are excellent in themselves and yet have a high potential when basic visual principles such as unity, variety, and spatial integration are considered. The problem then, is to investigate existing proto-types.
to determine principles of design and landscaping which would produce a better integrated and more stimulating visual environment. The culmination of this investigation, it is hoped, will lead to some proto-type which will demonstrate fundamental principles in their use in the total design.

Very truly yours,

O. Reuben Johnson
May 17, 1951

Mr. O. R. Johnson
335 Westgate West
Cambridge, 39, Massachusetts

Dear Mr. Johnson:

The Thesis Committee has reviewed your recently submitted thesis proposal, "A Study of Some Visual Considerations of the Gridiron Plan for Residential Subdivision". It is felt that this is an excellent subject, and we are very glad to approve it.

Sincerely yours,

Herbert L. Beckwith
Professor of Architecture
Cambridge, Mass.
22 August, 1951

Pietro Belluschi, Dean
School of Architecture and Planning
Massachusetts Institute of Technology
Cambridge, Massachusetts

Dear Dean Belluschi:


Very truly yours,

O. Reuben Johnson
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PART I

RESEARCH AND ANALYSIS
1. THE GRIDIRON DEFINED

Preliminary to a brief historical treatment of what has been called the Gridiron pattern in the design and planning of towns and cities, it seems necessary to define the term. "Webster's New International Dictionary" published in 1930 defines the term "grid" and "gridiron" as follows:

**Grid:** noun "A grating or gridiron, or something resembling or likened to one; as: (elect.) a perforated or ridged plate of lead for use in a storage battery, (Railroads), a gridiron track.

**Gridiron:** noun "1. an iron grating used for torture by fire. 2. A grated iron utensil for broiling food over coals. 3. Something resembling or likened to a gridiron; as a network of pipes, railroad tracks or the like; an open frame work of parallel beams or girders for supporting a ship in dock; the arrangement of beams over a theater stage supporting the machinery for handling the drop scenes etc. or the loft over this; the United States flag (slang); a football field for the American game.

**Gridiron:** v.t. "To cover or mark with bars or lines suggestive of those of a gridiron."

From these definitions it is apparent that the uses and connotations of the term are very broad. A dictionary illustration with specific reference to the pattern of cities is notably absent although the general nature of a gridiron of any sort is implied by examples of likeness; it must be called suggestive term rather than an accurately descriptive one.

The word is ordinarily used to describe the degree of likeness to the cooking utensil for broiling. It would therefore seem necessary to determine what are the pattern or form qualities of the example given. All of them imply strongly the existence of parallel lines in at least two directions, the two sets intersecting at right angles. Not even a
generalization can be made about the size or proportion of the shapes of the areas which these lines delimit except that they are predominantly rectangular.

In a broad geometrical sense it must be noted that even the characteristic parallel lines intersecting at right angles are not true limitations in definition, because in another sense of the word it has come to be associated with a composition of cellular units largely of the same size and shape. Although these units are usually thought of as rectangles, or perfect squares such a definition would not exclude a composition of unit hexagons, for example, which has often been termed the hexagonal grid.

It can be seen that if term grid or gridiron is to be used to describe a pattern of city design, considerable care must be taken so that confusion does not result. When a gridiron pattern is referred to as a planning form or pattern it has been most commonly thought of as having the following properties to a large degree:

1. A pattern whose major circulation system is composed of two systems of straight, parallel, streets which intersect at right angles.

2. The rectangular blocks or building sites defined by these lines are of the same order of size and proportion.

3. The straight parallel streets are in the majority of cases continuous through the pattern.

The foregoing comprise the essential characteristics of the gridiron in the most strict sense of the word. Although this definition of the gridiron is the one this thesis is concerned with primarily, it
seems necessary to discuss its variations. Rather than attempting to define verbally the degree to which examples of past cities conform to the above standards, it seems wise to employ both illustration and words so that the least amount of confusion may occur. Figs. 1 through 4 are intended to show in a rather complete way how the gridiron may be defined in some of its ramifications.

In the following historical analysis various plans of towns and cities will be referred to in terms of the degree (first degree, second degree, etc.) to which they conform to the standards as illustrated in the preceding illustrations.
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2. HISTORICAL ANALYSIS

It is not intended here to become involved in a precise and detailed analysis of the history of gridiron planning. Important and necessary as that may be, it must be the endeavor of a competent historian. It does seem desirable and necessary, however, to discuss some significant factors which are relevant to the origin and use of the gridiron through history.

Although historical reference will be made with respect to various points throughout this thesis it is necessary here to point out in a general way that the basic principles of gridiron planning are quite old and that they have been results of some logical considerations.

The Gridiron First and Most Widely Used:

When looking in retrospect one is amazed to realize that the gridiron pattern for planning towns and cities has been so long-lived and so widely used.

The town of Kahun, Egypt built around 2500 B.C., has been described as the oldest example of a planned town. Thomas Adams\(^1\) points out that some earlier examples in India exist to challenge Kahun as being the first, however, he characterizes both as being laid out in a formal or rectangular form. Because of the condition of the ruins of these cities it is difficult to determine accurately what it was like in many details, but it is clear that there was a predominance of straight streets, and rectangular blocks. It is possibly because these properties are present that historians agree and can recognize them as being consciously and comprehensively planned compared with the more irregular and

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1. Adams, Thomas. "Outline of Town & City Planning", p. 34.
Fig. 5. Selinus

Fig. 6. Aosta

Fig. 7. Alexandria
seemingly accidental growth of earlier towns. It is because of these characteristics that Kahun can be classified as a gridiron, although of a low degree. One might say that it falls between the second and third degree classification and under the A column since its total shape is rectangular.

In considering the planning of the great structures of various dates from 2500 B.C. to the Graeco-Roman period which have been uncovered in Western Asia, there is ample evidence to show that rectangular forms predominate and traces of city walls confirm the conjecture that the general planning of cities was also rectilinear. The most outstanding examples of this period are Babylon and Khorsabad. In Babylon the rectangularity has been considerably modified because of its disposition on two sides of a river but in a broad sense it can nevertheless be called a gridiron of the fourth degree.

The Greek and Roman cities existed about the same time and it is convenient to deal with both simultaneously. It is not possible to point more than a few representative examples, but this seems essential to show that the grid in basic principle is also prevalent during this period. The towns of Selinus and Alexandria planned by the Greeks, and Turin and Aosta planned by the Romans are good examples.

Selinus in Sicily is really a pear-shaped acropolis. Its shape is determined by the fact that it is built on a flat plateau. Yet it is composed of rectangular blocks which are truncated around the perimeter. It can be classified as a third degree grid, under the B column. Alexandria is a gridiron to a much higher degree in some respects. It is much more regular in shape of blocks and all of its streets are rigidly straight.
Although the City of Rome itself cannot be classified as either regular or gridiron, many of the Roman colonial cities are. The Romans were above all very orderly and practical. They considered the sites both on account of its adaptability from the military point of view and also from the facilities offered for commerce, traffic, water supply, and drainage. The model for all of their new cities originated in the "castra" or camp, divided at right angles by streets leading to four gates in the protective wall. The cities of Turin and Aosta are typical. Both are more nearly a pure grid than any of those previously discussed, and can be classified as first degree gridirons in the main.

During the Dark Ages and the Medieval period it has been thought by many that planning and town design reached a low ebb, because very little geometric regularity is evidenced in towns of this period. But even during this time the gridiron was perpetrated in isolated examples. The French town of Montpazier and the Bastide of Sauveterre de Guyenne corroborate this. Montpazier is clearly a first degree grid and the Bastide is probably of the third degree.

The Chinese towns of Peiping, Sian-Fu and Kaifeng discussed and illustrated by Thomas Adams\(^1\) are difficult to locate chronologically because they are results of growth over a long period of time with many additions to the original development. They are however strikingly rectangular and regular, and therefore can be classified as being fourth degree grids. In Peiping it is interesting to note that although its various parts were executed at different periods of time, the city being reconstructed in 986 A.D., enlarged in 1122 A.D. by the Tartans, and com-

\(^1\) Adams, Thomas, "Outline of Town & City Planning", pp. 46-50.
pleted under Kublai Khan in 1267 A.D., it retained a remarkable regular uniformity. The large blocks are rectangular in each portion and are well integrated. Were it not for the protective walls which delineate each part it would be difficult to recognize that its parts have been built during different periods.

Town design during the Renaissance period in Europe was largely concerned with schemes for remodeling and beautifying the cities which had grown during the Medieval period. What was accomplished was mainly inspired by sovereign princes by way of trying to improve the surroundings of palaces and to create the grandiose town. Therefore no examples of new towns or gridiron planning have been noted. Those towns or parts of towns that did exist in a gridiron pattern were also involved in schemes of remodeling in that diagonal streets were superimposed on the grid primarily for the purpose of achieving grandiose vistas terminating at important buildings.

It was during and after the Renaissance period in America that the Gridiron is manifested in an unprecedented degree of use. The greater part of a whole continent was developed according to a system of grids. The well known examples of the United States towns and cities need no further discussion to establish the fact that they exist in great number.

Formative Influences in Gridiron Planning:

It has been established by the examples just mentioned that the grid was the first and most widely used form of planning in the past, but it also seems desirable to determine why this should be the case. What
factors were responsible for its intensive and continued use over such a long space of time?

The Correlation Between Social Structure and Physical Pattern:

It is significant that most authorities have proposed that a definite relationship exists between the pattern of towns and the social structure prevalent at the time of its origin. Thomas Adams, L. Hilberseimer, and many others point out that the geometric patterns in town design are generally the result of autocratic forms of government, colonization ventures, and military cities or camps. The non-geometric or "organic" patterns are characteristic of free people with no imposed or regimented forms of rule. Hilberseimer says that "one may generalize from ample evidence that all mystic peoples (like the peasant) in accordance with their principles of growth arrive at organic city formations; and all magic peoples (such as nomads) because of their rational spirit arrive at a geometric city formation". 1

There are a good many examples that can be pointed to which will give support to this theory. The Roman camp city and colonial city without exception are geometric. Peking (now Peiping) was originally a camp city which was autocratic. Montpazier, one of the few gridiron towns in the medieval period can also be explained on this basis since it is presumed that it was designed and built by the English during their conquest of the 13th century. During the Renaissance period in Europe, one marked by a strong ruling class, the organic patterns of medieval

growth were superimposed with geometric patterns designed to accent buildings of the rulers. The gridiron patterns in the colonial development of America can also be explained partially by this thesis.

This evidence would seem to establish a fairly conclusive case for the correlation between the gridiron and other forms of geometric design, with autocratic, military, and colonial forms of government. It would seem however that there is a danger in attempting to make this somewhat narrow correlation. If one is to make an analysis in more broad terms it might be said that what is really important is a strong and directive form of rule or government working with a clear purpose over a short period of time. A well organized social structure, it is submitted, is necessary to orderly planning, and orderly planning at this point implies a geometric pattern. The study of history would seem to establish the fact that collective man often needs and submits to strong leadership to accomplish, not only big things but also planned things. It is probably no more than a historical coincidence that the most directive and highly organized forms of government have been autocratic, military, and colonial. It is submitted here that only a highly organized social structure is apt to create orderly cities.

The Rate of Growth:

It is significant that the "organic" pattern is usually the result of a slow growth as well as being a consequence of a lack of a stable and continued leadership. It would appear that rapid growth if planned is more apt to be uniform and geometrical because changing conditions are less likely to effect or distort the initial concept. The
military and colonial towns are typically ones of an initial conception executed within a short period of time.

Hilberseimer says that "Organic cities express slow but planned growth." At this point it seems necessary to discuss what planned growth actually means. A distinction must be made between planning and comprehensive planning since there are many who hold that the Medieval towns were comprehensively planned.

There are few who will deny that this form of slow growth was planned to some degree. To what degree it was planned is the question. The term planning implies a regulation of present activities with an anticipation of a long range consequence. It would seem that planning in the organic town was concerned primarily with immediate expediences. No doubt due consideration was given to the immediate problems but only to the extent that it was a piece meal sort of thing. The theory that organic growth is planned is often in contradiction to another theory that it was the result of a laissez-faire situation. Those who choose to credit the organic pattern with a comprehensive planning technique cannot probably be disproved but the same type of pattern probably cannot be condoned today in spite of their convincing arguments.

The foregoing is not to say however, that slow growth cannot be regular or geometrical. Peiping is one example of orderly geometric growth over a long period of time. Nor is rapid growth always orderly.

Man's Inherent Tendency Toward Geometrical Order:

The very nature of man himself is probably responsible for the

11.

extensive use of the gridiron because it has been suggested by many that man is inherently orderly. Abercrombie says that "man has a passion for creating symmetry, regularity, and neatness".¹ Le Corbusier says that "Man, by reason of his very nature practices order."² The expression of this tendency can logically be manifested in geometry.

It would seem that a good case for the rectangular subdivision of land can be made in terms of simplicity. Solutions to any problem by rational man lead to a simple straightforward result. Given the problem of achieving an orderly arrangement of buildings and circulation, it is difficult to conceive of a more simple or direct approach than what we call gridiron subdivision. On the basis of simplicity alone it seems logical that it should evolve as the first recognized prototype of city planning expression. It also seems logical that it should receive continued use as long as it satisfactorily provides for what it was intended. In general it can be seen that it was above reproach from a utilitarian point of view during most of history and that it is only recently that the motor vehicle has pointed out some of its failures in contemporary application. It will be seen that the visual problems were quite often competently dealt with in the past, and that even on that basis it cannot be reproached too loudly.

It often occurs however, that man's tendency toward a geometric order is violently opposed by other factors. From the time of the Fall, man has been engaged in a constant struggle with nature for his very existence. To say that man can always create in sympathy with nature

would be a great paradox because the nature of man often leads to opposing it. There are certain incompatibilities between nature and man's desires and needs which often times impel man to be at odds with nature. This is apparent in the planning of his urban environment.

Probably it is man's tendency to be orderly which accounts for such examples as Priene and San Francisco, since it must be recognized that considerations of geographical location and topography often have been instrumental in the selection of sites for settlement. It is significant that the sites which many times offer the best potential for trade, defence, industry, water and food, and visual pleasantness do not readily submit to an orderly arrangement.

To the contrary most frequently such considerations impell a location on sloping banks of the sea, high rocky plateaus, and points of converging streams of water, etc. Man's tendency to order nature is dramatized when it is realized that occasionally large man-made topographical changes have been resorted to for the sake of order and utility. Much Roman work exhibits this tendency. Unwin contends that the Greek towns were quite sympathetic to natural features while Roman designers frequently made the site conform to their wishes.¹

There are many examples of the application of a grid to reasonably level but irregularly bounded sites such as plateaus, peninsulas, islands, and valleys. Some specific examples of these are Selinus in Sicily, Rogusa in Dalmatia, and New York City in this country. In the majority of cases the otherwise uniform grid is truncated to conform with the boundary; leaving varying shapes and sizes of truncated rectangles around the perimeter. There are two methods of attacking the subdivision

of an irregular shape; one to orient a uniform geometrical pattern, such as a grid, in such a manner as to produce the least amount of irregularity at the perimeter; the other is to approach the problem from the perimeter by trying to establish a geometry from the general outline of the site. Obviously the first approach in most instances will achieve the more orderly arrangement of the whole.

The Rectilinear subdivision of land can be justified in another way. If it is recognized that the predominant shape of buildings in plan through history is rectangular, there is considerable reason for subdividing land into rectangular shapes. If one assumes that rectangular shapes fit best and in a most orderly way in other rectangular shapes the rectangle in town design has added significance. If it is recognized that even today the most prevalent shape of structures in plan is rectangular, this might indicate a reason for its continued existence in contemporary city patterns.

The Sites of Gridirons:

It is usually dangerous to generalize but there is ample reason to conclude from the evidence of history that the gridiron has been most widely and successfully used on gentle terrain. To be sure, there are many towns which have imposed a gridiron pattern on very irregular topography. The towns of Priene in Greece, San Francisco and Duluth in this country are notable examples. The ancient town of Priene uses a grid on a site so hilly that most of the streets become staircases. San Francisco has become famous because of its steep streets and cable cars. It should be observed, however, that in locations of mild climate where ice
and snow are not problems this condition is not such a handicap as in
the case of Duluth, Minnesota. Here in the winter periods the problem
is very serious.

A survey of the past would lead one to believe however, that
where sites have been consciously selected, where towns are not the
result of natural and spontaneous growth, and other considerations of
trade, sustenance, and defense being equal, there has been a preponder-
ant selection of level terrain for settlement. This is noteworthy be-
cause it is on level terrain that man encounters the least resistance
to producing an ordered environment.

In addition to this basic factor there are several other
reasons of a more practical nature which lead to a choice of relatively
level sites when possible.

1. Uniformity in terrain facilitates a maximum degree
   of mobility for man. This implies movement in a
   straight and direct path as compared with the dif-
   ficulty of vertical movement to achieve directness
   in rough terrain.

2. Relatively flat sites make possible a simple and easy
   location of structures and service facilities.

3. Recognition of the first two points would imply an
   inherent economy in the expenditure of both time and
effort.

It would appear that these were basic factors of considera-
tion whatever the time or period.
Fig. 10. Peiping, China.
The Flexible Aspects of Modified Gridirons:

A study of the grid shows that it is flexible in two respects; the size of the basic unit, and the general shape of the unit. The slavish use of a rigid gridiron is not typical of many of its early applications. The size of the rectangular block, and its general shape (at certain occasions forming trapazoids and parallelograms) were changed without reticence when factors of terrain, functional size, and visual problems indicated an advantage in departing from it.

The town of Peiping is a good example of this. It is interesting to note that rectangular superblocks of varying size and shape were used here and that they are not peculiar to our day and age. Although the gridiron here has been modified to the extent that it is difficult to recognize, it is interesting to conjecture on how it might be applied to irregular terrain. Fig. 10 shows how it might have expressed a compromise between man's desire to create order and some features of terrain which would oppose him. It is presumed that the terrain is relatively level in Peiping but adding imaginary contour lines in addition to the obstruction of existing historic remains and sacred spots shows a striking possibility for contemporary use.

There are several other points which have effected a modification in the pure form of the Gridiron pattern. There seems to exist a definite relation between the size of a city or town and the regularity with which the grid is applied. Many towns in their growth have exceeded natural boundaries which were original limitations in the original design and subsequent growth has shown a change in pattern where it has occurred on adjacent areas of relatively steep terrain. Examples of this are plateau cities built for defense, and those built in valleys.
If all factors of terrain and pattern of living, etc., remain the larger cities seem to indicate less of an ability to impose an ordered pattern. This would indicate that the degree of control diminishes with an increase in size.

A circulation problem well recognized by most authorities seems aggravated with size -- that is -- the inherent opposition of the gridiron to radial circulation toward the central area. As cities increase in size there is more evidence of diagonal streets superimposed on a gridiron under-pattern to alleviate the problem of circuitous travel. Although some of the diagonal cutting of streets must be attributed to a social structure concerned with aggrandizment, the factor of convenient circulation cannot be overlooked.
3. ORGANIC ORDER vs GEOMETRIC ORDER

"It seems...if one must generalize...that even when the site has nothing to say to the architect, and a formal rectilinear layout seems inevitable, it should nevertheless be avoided."¹

Lionel Brett

"I repeat that man, by reason of his very nature practices order; that his actions and thoughts are dictated by the straight line and the right angle, that the straight line is instinctive in him and that his mind apprehends it as a lofty object."²

Le Corbusier

The foregoing quotations of city planning authorities focus attention on a basic design controversy which is fundamental to any consideration of the visual quality of the gridiron pattern.

The Two Schools of Order:

Before 1889 when Camillo Sitte's valuable book entitled "City Building According to Its Artistic Fundamentals" was first published in Vienna, there was no recognizable controversy about the medieval city as being a conscious design effort. Although prior to that period the interesting visual qualities of medieval and other irregular cities were recognized, they were thought to be mere happy accidents which occurred in a natural growth. There was however, during this period, and prior to it, a movement in an art allied with town design -- landscape design -- which revolted against the formal geometry of design which was prevalent in both arts. This revolt was characterized by a back to nature

¹ Arch. Review, November 1949, p. 317
² "The City of Tomorrow". p. 17
movement where nature was worshiped as the inspiration and only source of true beauty. But before Sitte there is no evidence of what one can call a movement away from formal geometric design in town planning. With the publishing of Sitte's book a controversy ensued, with all artists, architects, and planners, taking sides, which is still raging today, and it would seem at no decrease in tempo.

The first significance of Sitte's doctrines was thought to involve only isolated areas for more sensitive and picturesque visual treatment. And therefore it was basically an argument of formal design as typified by the sterile and symmetrical French gardens and grand streets, versus the informal or picturesque design of the self styled followers of Sitte. It became a matter of personal choice between the two schools of design, irrespective of the appropriate use of either "style".

Later it became apparent that a new terminology was necessary to describe a maturing attitude toward town design because broadly speaking all geometric designs were not necessarily formal, although picturesqueness was thought of necessity to be informal. Subsequently the geometrical type became known as the "regular" type of pattern and the informal or picturesque was termed "irregular". But the significance of picturesque design in a broad way came only with the realization that wide spread use and acceptance of picturesque design involved a basic principle of art -- that of order. At this point "organic order" was coined and became somewhat synonymous with the informal or picturesque as contrasted with a more universally accepted order which is recognized in the gridiron.
What is essential to order? What are its general visual implications? What is the place of order in the hierarchy of design principles with respect to town and site design? Is the so called "organic order" really a comprehensible order? It would seem that these are the fundamental questions to be resolved. It is about these points that Sitte's principles of visual design must be investigated and evaluated.

To define order as a principle of art or town design must be the job of a Ruskin. It is however necessary to explore into its implications. It would seem that it firstly must concern the individual — that order to be order must be comprehended as order, and that it therefore is related to the capacity of comprehension.

**Impact of Size on Order:**

To a certain extent order in a large composition implies a harmony and repetition of basic units or pattern to make comprehension possible. Repetition of units is one basic way to achieve order. It is necessary in considering the implication of the town order as a principle of art to realize that there is a difference between art as practiced in painting and the art practiced in city design. It is fundamentally a difference of scale with relationship to the human being. Erno Goldfinger\(^1\) has discerned and stated very clearly that any artistic creation must fall into either of three categories:

1. **Pictorial:** Two dimensional representation such as paintings.

2. **Plastic Convex:** Three dimensional representation such as sculpture.

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3. Plastic Concave: Three dimensional representation such as building or city spaces.

True town design is concerned with either plastic convex, plastic concave, or both. One may be viewing a whole city from a distance or from an airplane in which case it is plastic convex. Or one may be inside the spaces of a city and then the art object becomes plastic concave. In the pictorial and plastic convex classification any intended order in the design is quite easily apparent because the whole is easily accessible to scrutiny. But in the third classification the scale of the design is large, man is enveloped by it, only limited portions of the whole are discernable. The order of the whole is beyond immediate comprehension except by a past experience in adjacent areas, for instance, and the correctness of ones anticipation of what lies beyond. It would seem that to be aware of this scale of order a somewhat less complex composition is necessary to a comprehend- able order. It is submitted therefore that order implies simplicity to some degree in town design. Simple geometric patterns, the grid being only one possibility, have considerable merit when order as it is here defined is a consideration.

The Significance of Pattern:

Sitte and others show an inclination to ignore pattern as a consideration in town design, because patterns make no appeal to the perception of space, since pattern is seen only on paper or by an airplane. It is well recognized by most competent designers that used as an instrument by itself, it is wholly inadequate for the study of a three dimensional design. But it is submitted that in a large scale space design,
pattern cannot be excluded as a factor because there is a strong relationship between the pattern, the resulting spaces, and the order of a large scale space design. Pattern expresses a system and system implies order.

Under certain circumstances man interprets space in terms of pattern. If one enters an unfamiliar area of a city or an unfamiliar city for that matter, man's subconscious facilities immediately set about to establish an order in the total composition. There may be many methods of approach but pattern is easily comprehended and is the first resort. The fact that two dimensional diagrams -- our maps of all descriptions -- play such an important role in a comprehension of order would substantiate the importance of pattern. From another point of view it might be held that first becoming familiar with a complex of spaces man subconsciously organizes these spaces in terms of pattern to help him comprehend them. This can be established by recognizing that individuals, when asked to draw a map of a particular area with which they are familiar, can do so.

Now, if pattern can be accepted as an essential factor in the comprehension of space, and if one recognizes that simplicity is a necessary element in large scale space design, one must question the justification of using patterns representing complex organic cell tissue or organic picturesqueness and so forth as a basis for a visual form. It is here that the pattern is easily comprehended only on paper. Although such a pattern may be significant in expressing social and economic structure or terrain, it is a deterrent to a visual comprehension to space. Certainly care must be taken to insure against the use of such patterns
where this significance does not exist. If a pattern suggesting rough terrain is used on land which is relatively level for example, there is nothing to recommend its acclaim except possibly picturesqueness.

It should, however, be recognized that certain "organic" shapes, maybe simple and comprehensible when considered as a single unit, such as in Fig. 11. But it is in their relationship with other similar units, as in Fig. 12, that they usually fail to establish a comprehensible order in large three dimensional space. In this type of pattern a sense of direction is difficult to establish and maintain.

Sense of Direction:

There would seem to be another requirement for visual order in a large scale composition -- the ability to maintain a sense of direction. Certainly there are few who have failed to experience the discomfort of emotional and psychological confusion that is felt during movement in and between spaces which are completely void of directional order. Since any art is concerned with the emotional and psychological, as well as the visual, the directional quality of a space composition must be a consideration. Even in the case of abstract work -- that is in pictorial representation -- direction is necessary as evidenced by the natural tendency to select a top and bottom for purposes of viewing it.

The meandering pattern is obviously the worst enemy of a sense of direction. At first inspection it would appear that a more simplified geometric pattern is essential but not all geometric patterns will satisfy this condition. The easy maintenance of a sense of direction is contingent
Figure 13.

TOWARD A LOSS OF A SENSE OF DIRECTION
to a large degree on straight lines since to go from one point to another in a straight path involves no change of direction once it has been established. It might be thought then that a system of straight line paths of circulation, both visual and physical, will inevitably lead to a space design that will be good for maintaining a sense of direction. Upon further inspection however one can see that there is another fact to consider, and that is that even in a system of straight line circulation, changes of direction are necessary as indicated by the existence of intersections. The number of varying directional straight lines which are involved in a system and the number of these which intersect at a point are also important. If one can accept the gridiron pattern as being one of the best for directionality, and it seems logical to do so because in its pure form it involves only circulation in two directions, and intersections consist of two straight lines intersecting at right angles. It is possible to illustrate this by a sketch (See Fig. 13) of a series of San Francisco's Market Street intersections showing how the addition of more lines of direction lends to a confusion. There are few to be sure who have not experienced a loss of direction either in this San Francisco area or in similar spaces of other cities.

Compositions involving a series of curves in their pattern in large scale spaces, quite obviously make the establishment of direction very difficult. And basically this fact is because the direction in these patterns never remains constant. It is always changing and therefore is comprehensible only to those who are intimately familiar with its spaces. Strangely enough it is just this fact which in the picturesque form of space design, is instrumental in achieving interest. If
however, a system of straight lines and curves, or even curves exclusively, are used in a simple geometric way so that spatial experience is related to and interpreted by a visualized pattern an order and direction can be preserved. And if the scale of circles or curves is small so that they can be comprehended pictorially then they become related to a frame of reference at all times and direction is more easily established.

It can be seen then that the ability to establish and maintain a sense of direction is contingent on simplicity -- simplicity in number continuity, and linear form. Apparently simplicity should be striven for to the extent that it does not hamper the effectiveness of other considerations.

One question that will inevitably be asked is this--is a sense of direction necessary or desirable at all times during a visual experience? Probably not. But one might say that it should exist to an extent that points or lines of good directional orientation are not too far removed from a point where it may be lost. The opposite illustration (Fig. 14) will show how this situation might be achieved much as in Peiping where the scale of the grid is large and readily supplies a point of orientation when approached after being in the more confusing central areas.

Some Popular Fallacies:

It has been widely pointed out and generally accepted by the layman that a loss of visual interest is the consequence of a comprehendable or geometric order. The editors of the Architectural Review
bring out this fact in writing about the "Popular Fallacy on the Quaint and the Beautiful".

"New building developments which replace old cozy world corners by a more efficient but visually barren form of environment has encouraged the popular belief that the quaint and old alone is beautiful, and that the orderly and newly planned, though it may work, does so at cost of beauty. As a result there is a popular indifference to the idea of town planning. It is respected for its presumed efficiency but deemed incapable of evoking anything but order in the most arid sense."

It must now be asked if visual sterility is an inevitable by-product of a geometric order.

Until recently a geometric order has been an excuse for not planning in detail — that is—dealing with the visual problems which are inherent to an orderly composition. It seems a city was thought, by many, to be comprehensively designed if a mere order was evident. It must now be realized by those concerned with town design professionally that what the layman has contended, is very true. It remains for us to get beauty identified with the orderly. For one to say that the curved and meandering street is inherently beautiful, and the straight one is doomed to ugliness, would be a rank injustice to the ability of the artist to create comeliness. It is often held that when the most severe limitations have been imposed on the artist the best result is accomplished. In the next part of this thesis it is hoped to show that the space designers' palette has so many veriegated colors, figuratively speaking, that with a sensitive and comprehensive approach straight streets and identical blocks for units—that is identical in size and shape—need

not give any visual quarter to the picturesque or "organic" design, although visual potency in the latter may be more easily achieved with less effort. Even Sitte whom most of his self-styled followers have misinterpreted recognizes that "straight lines and right angles do not necessarily lead to banal effects". Many upon reading his book have jumped on the bandwagon for curved streets, etc., without discerning as Hegemann and Peets point out, that his own work is not typified by this sort of a copyist application. He has succeeded in isolating basic principles, many of which are universal in their application regardless of whether streets are curved aimlessly or not.

It has been previously mentioned that a geometric order does not necessarily imply a formal or monumental expression although it is a popular belief by both laymen and professional men. The Architectural Review writing "Concerning the Fallacy that Planning Means Formal Design" points out that order "involves neither things in rows, nor symmetrical arrangements, but a dovetailing of parts or activities in such a way that each component functions efficiently without prejudice to the whole." This statement hints at the varying character which can be achieved, without sacrificing order.

Effect of Terrain on Order:

The imposed limitations of terrain, or the lack of those limitations, has considerable impact on the order which can be achieved in the

design of city spaces. There are many divergent views as to what should be its effect on design. Most are concerned with an aesthetic sensitiveness to expressing terrain sympathetically. Therefore many of its facets are relatively intangible and subjective. In hilly terrain such practical expedients as sanitary services, comfortable grades for auto and pedestrian, etc. often times lend a definite direction. On relatively level terrain however, when void of obstructing features of any kind the problem is much more controversial.

There are many who hold that on relatively level terrain it is the elements which obstruct the regular and uniform application of a geometric pattern, that save it from visual impotency. Abercrombie makes this statement. "Fortunately in both the new and old type of plan there are factors which make for breaking up the standardized regularity of the pioneer or organizing spirit."¹ His attitude is typical of those who seek out dominant natural features such as terrain irregularities, and human features such as historic remains or sacred spots as the salvation of visual quality in geometric patterns.

These men apparently are looking for obstructions to justify a departure. It would however seem that visual interest might also be achieved without departing from a basic pattern of streets, although one must admit that this is the most obvious method to employ. The circulation pattern might remain intact, but the building pattern as determined by size, height, color, etc. might be suddenly changed to provide a

visual impact. In other words the circulation pattern is only one pattern of a city which lends itself to departure in the interest of achieving a visual impact.

The extreme opposite of this situation is referred to in a letter to the editors of Architectural Review.¹ A man named John Sutcliffe bares an accidental visual quality in San Francisco as a result of the Grid being forced upon hilly terrain.

"On a recent visit to the United States I was more impressed by San Francisco than by any other American city, and I believe the unwise layout gives it tremendous quality and character. In its switch-back street one can enjoy the conflict between relentless American planning and unyielding nature."

Those who have studied San Francisco from this point of view most certainly agree. It is unfortunate that such a striking visual quality must be at odds with more practical considerations.

In general it is submitted here that where a uniform pattern or geometric order for circulation is feasible, and where it has both visual and utilitarian advantages it should be strongly considered. Every effort should be made to deal with its visual problems competently before it is discarded. The degree of its uniform application will certainly vary considerably with the situation, but it would seem a great tragedy to impose a non orderly or "organic" pattern where a quantitative order is easily achievable. Even when hilly terrain is to be wrestled with, every effort should be made to apply a comprehendable geometric order when it is not felt, after due analysis, that it imposes too many practical hardships. This is not to say that this order must result from

¹ Arch. Review, March 1951, p. 196.
a hard and fast application of the grid as it is prevalently used, but
a possibility of a modified grid of some description does suggest itself.

The Position of Order in a Hierarchy:

The place of order and its visual nuances, in the hierarchy
of city planning determinants is really a matter of compromise. Rarely
if ever do the aesthetic and visual considerations stand alone in a de-
sign of any kind. One is always confronted with practical considerations
which seem diametrically opposed to artists' and designers' pre-con-
ceptions. The point at which visual considerations should govern can-
not be located by dogmatic rules, nor is it important. Rather the visual
factors must be a quantity of which all men are constantly aware, what-
ever the project.

Too often in the past design, whatever the project, has been
delegated to specialized technicians with little or no sensitiveness to
visual qualities. Because of this unfortunate circumstance many designs
may have a sound and logical order but miss visual satisfaction only be-
cause the artists eye is absent in bringing it to its logical visual
fruition. Most existing gridiron developments are examples of this. If
what Hegeman & Peets recommend were observed in every space design, city
design, or any other facet of design for that matter, the visual quality
of our environment would benefit immeasurably.

"No city planning project should be undertaken nor
report issued without the sanction of at least one trained
man whose primary interest is in the dignity and beauty of
form and color." 1

Order implies, to a certain extent at least, some degree of

uniformity and repetition of basic units. A natural tendency toward an order of this type -- often manifested in a geometrical pattern -- is the result of the impact of industrialization, its resulting standardization, and its emphasis on technical aspects. The technological emphasis, moreover, seems to be responsible for a diminished consideration of visual quality. In a technical age, technical problems are first solved, and the visual problems imposed by technology come to attention later. It seems we are now at a point where the visual aspect must catch up with the technical advances.
4. THE MONOTONY OF GRIDIRONS

"The designers of many of our modern villas, however, aim at diversity, but they achieve monotony, not only a monotony of spirit but an actual formal monotony, for variety of the nondescript makes no more impression on the mind than does a heap of stones all cut fortuitously to different shapes." ¹

Trystan Edwards

**Basic Principles of Art Involved:**

The word "monotonous" has probably preceded the term "Gridiron" more often than any other descriptive adjective. From a visual point of view this supposed quality of a lack of interest presents itself as the crux of most visual problems of the gridiron pattern.

To understand the full implication of monotony when applied to any work of art is necessary to a comprehensive analysis of the gridiron. When anything is described as monotonous with a visual connotation it implies a host of basic art principles, as one who has tried to analyze those principles in an objective manner cannot fail to realize. Monotony is inextricably associated with the fundamentals of unity, variety, points of interest, and focal point. In the same breath one must include modifying factors of these principles which include value, color, texture, repetition, rhythm, etc.

**Unity:**

Order as a principle of large scale space design has been discussed in the previous section. But because of the inseparable nature

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of any one principle from others it must now be isolated and related to the principle of unity. Order implies unity to a considerable degree, and vice versa. It seems impossible to conceive of order if there is no unity in the thing one is considering. Unity can be defined as a harmonious integration of a number of parts which give an impression of correlated oneness, and harmony implies some degree of similarity in shape, form, color, value, or texture.

There are several ways to achieve unity. Unity can be achieved by emphasis of a dominant element in a composition, thereby subordinating the minor elements. Trystan Edwards illustrates this type of unity when he says that

"The only way in which a town or village composed of thoroughly unsociable buildings can become pictorial in character is by the introduction of one immense structure, preferably a church, which towers over the scene. Thus the miscellany of units, which in themselves compose a discord, are reduced to a certain kind of order, and compose into a group by reason of subjection to a single dominant motif,"

Unity can also be achieved by repetition – that is – repetition of one, several or all factors of shape, form, color, value, etc. The degree of unity considered from this point of view depends on the number of these which are repeated. Repetition of any or all of these elements usually establishes a rhythm, for example an equal spacing of objects such as buildings of same form and size, or the repetition of similar and analogous rectangular blocks in the gridiron pattern also establishes a rhythm and like-wise a strong unity.

Variety:

It can be seen however, that unity, as defined here, when present to an excessive degree is in direct opposition to another basic visual principle—variety. Variety being the element of a composition which produces interest or visual stimulus and that is, in essence, the antonym of monotony, which is the chief concern here. Monotony then, is produced by the lack of a sufficient amount of variety.

In any composition there must be a constant tension between unity and variety. One thing that makes any art subjective is that determining the amount of each of these compositional ingredients defies rules or formulae. What is a good proportion of these ingredients in one case may be bad in another. One could say that a composition should possess enough variety to be stimulating and interesting, but not so much as to destroy basic unity. This optimum point of visual satisfaction can be determined only by those who create the composition.

It has been stated that unity can be achieved by repetition of one, several, or all of the elements of shape, form texture color value, etc. It would seem apparent if all of these modifying factors of composition are repeated uniformly throughout the composition there can be no variety—only monotony. Furthermore, it would seem that no composition need depend on repetition to that extent to achieve unity. Rather one strong element in repetition can usually achieve unity. The remaining can be used in such a way as to contribute to a variety. To illustrate the point one might take a series of rectangular units of equal size and shape, abstractly composing a grid. If all of these units
units are of the same color texture, value, etc., then there can be no variety, although one might say there exists considerable unity. The crux of the problem of monotony lies in number and quality of elements repeated and the extent to which they are repeated. Thomas Sharp\(^1\) has analyzed the situation very thoroughly when he says that repetition of even the best elements carried too long will produce monotony. He goes further,

"The avoidance of monotony lies, therefore in repeating the unit of design only for so long as it can maintain the interest of the beholder."

**Pattern Study:**

Considering an abstract grid (Figs. 15-19) the obvious way to introduce variety and yet maintain the basic pattern would be to introduce different and contrasting textures, colors, values, etc. Fig. 16 shows what a remarkable increase in variety or interest can be achieved by using just one element - variation and contrast of textures. It can be seen that the size of a grid pattern could be considerably increased in the number of identical units which form the composition if the number of textures which is available to the artist is many. To be sure, it may not be the maximum of variety that can be achieved without destroying unity but within the limitation arbitrarily set, it represents an achievement.

Now if in addition to texture, one adds further tools which modify unity in that they are capable of producing variety, such as color and focal points, it can be seen that the variety potential has

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been infinitely increased. All this variety has been achieved without changing the basic shape of the composition. (See Fig. 17).

To go further in an attempt to produce variety one must consider the possibility of changing the component shapes, as an additional tool. In Fig. 18 the component units are still rectangular but not equal in size. Yet they are similar and analogous. The basic quality of a grid remains apparent although slightly modified. A strong geometric order and unity still exists. All lines are straight, continuous, and intersect at right angles with each other.

In Fig. 19 the ultimate in variety is approached. Again the basic grid is in evidence but it is less apparent. Shapes are no longer similar to the extent that they must always be rectangles. Yet major or dominant lines are continuous.

Although the compositions illustrated here are of a common scale or size it can be readily seen that as the illustrations progress in complexity because of an added number of tools they could be applied to an increasingly larger area without tending to produce monotony. If all five of these were again grouped into a grid of its own, each unit having the inherent quality of variety which was evident when considered singly, a whole new aspect of variety is brought in focus.

The foregoing discussion and illustrations are intended to show that the means of achieving variety truly approaches infinity for the competent designer, and that monotony is not an inherent evil in the use of a standardized unit. Furthermore, it can be said that unity can be achieved by a repetition or dominance of any element; it need not be by repetition. In other words one might have a series of shapes or forms
which had no tendency toward unity in themselves because of a lack of repetition or rhythm or dominance, and yet unity can be had by introducing a repetition, rhythm or dominance with the use of color. And so for any other tool capable of producing unity.

**Analogy Between Pattern and City Grid:**

It remains now to draw an analogy between the abstract patterns represented by the foregoing sketches and the visual problem of monotony which some say is inherent in the Gridiron pattern of city design. Here again one must consider pattern with the realization that it has an obvious impact on three dimensional space.

For the sake of illustrating a point it is convenient to assume that because of practical and visual considerations a grid pattern of some form or other is most desirable and the most limiting factor in the design of a city or some particular area of it. The pattern then seems the logical thing to exploit as a unifying element.

Just for the sake of comparison one can assume that the dominant, continuous lines of the abstract grids represent through ways and main thoroughfares in a hypothetical grid city and therefore define a pattern. The fact that an orderly, rhythmic, and repetitive pattern lends assistance toward unity is certainly favorable. Now if in Fig. 16 the pictorial texture can be compared with a three dimensional space texture as represented by building types of different size and intensity. These different space textures can be illustrated by pointing out the existing variety of space texture created by areas in our cities zoned for single family residence, multifamily residence apartment buildings
of all types and sizes, commercial areas with their different space
textures, and the altogether different textures of industrial areas
and open park space. Unfortunately in most of our present gridiron
cities no coherent visual pattern of these varied textures is evidenced,
so that their potential variety cannot be interpreted and related in an
orderly and varied visual experience. Suppose for instance, that the
dotted areas in the illustrated abstract patterns are single family
houses, the cross hatch areas - multi-story apartment houses, the scribbly
pen-made texture were local commercial, the untextured areas are parks
and open space, and the dots are focal points or points of interest,
natural or man-made. If these areas were composed visually as well as
functionally the same variety could be achieved within a grid pattern
that is illustrated on the abstract composition. But it seems our space
textures today are too much like Fig. 15, too much unity over too extended
an area with little or no contrast and variety either in space texture
or other qualities.

There are of course other textural considerations such as tex-
ture of materials and surfaces which play an important role in variety
but on a smaller scale. The necessity to organize them into a visually
coherent pattern exists also but they are not important to discuss at
the moment. Also, the delimiting boundaries of various textured areas
need not be through ways. A overlapping pattern of space texture over
a circulation pattern might have certain visual and functional merit.
(In Fig. 16 the dotted texture shows this.)

It is also possible to draw a similar comparison between the
abstract patterns and a grid pattern for cities using color as a basis
for variety. For instance, one area expressed by the lines representing thoroughfares might be predominately of one color to establish a unity within that particular area but when contrasted with different predominant colors of adjacent areas it could produce a variety when the whole complex is considered. This does not mean that the color within the unit space must be monotonous when considered singly. Although one hue may predominate for the sake of unifying the particular area, variety might be achieved by varying the chroma and shade of that color as well as introducing accents of complementary or contrasting hue.

Although the foregoing comparison of an abstract pictorial representation may be of value by way of furnishing inspiration for a practical application of visual design principles to future cities and their areas, it is important to state clearly that the comparison is not made with that intention. The whole problem is of such a complex nature one must hesitate to advance oversimplified theories which cannot be practically executed. It is intended only to show in as clear and as forceful a way as possible that a gridiron pattern of circulation need not be monotonous if the problems are sought out and dealt with competently.
5. THE MONOTONY OF STANDARDIZED UNITS

Up to this point monotony has been considered primarily from
the viewpoint of the gridiron pattern. This thesis professes to deal
with its application in residential areas. It is therefore necessary
to discuss some of the general problems which are concerned with an
evolving pattern of the individual domestic structures — for it has a
far reaching significance in any evaluation of monotony, variety and
unity.

The Visual Problem:

There has been much concern and considerable vehement criticism
that industrialization and mass production techniques which promise an
answer to our country's housing problem will inevitably result in an
incurable monotony of a few standardized prototypes for lower income
families in particular and it is this group that comprises the largest
number of houses when the whole complex is considered. It must be ad-
mitted that, except for a few examples, there is good reason for alarm.
There are more areas which are composed of standardized units which ex-
hibit monotony than there are those that can make any claim to unified
variety. The question is — is this monotony incurable? If not, what
is the prescription for its cure?

The Problem of Individual Expression:

Aside from the basic visual argument that standardized types
will produce monotony there is another point which is controversial.
Many contend that the use of standardized units for families of varied
personalities and ways of living inhibits a necessary expression of individuality. There are others, Mondrian is one, who say that individualism must not be allowed to destroy an inseparable unity between home street and city. This point is also vital in a visual study because an expression of individuality is largely a visual problem and even the argument that standardized units daunt expression of personality is not necessarily unsolvable. At this point it can only be offered that the solution may be in putting individualism in its place. If the practical problem of a better solution to housing of low income families lies in the use of a standardized house to some degree, the arts certainly must accept the challenge to solve the related problem of an individual expression with this imposed restriction. Certainly no one can doubt the intrinsic right to individual expression if it does not conflict with the harmony and unity of the whole. The very fact that one accepts the need of expression of individual taste and personality is the major motivating factor in the expression of variety.

Unity in Retrospect:

It is noteworthy that a potential unity such as mass production & standardization offers has not always been scorned as many do today. A study of the past would lead one to believe that a standardization of domestic units is not a development which is typical of the machine age alone. One might also be led to conjecture that many conscious attempts to unify street pictures by repetition of standard units have been the result of a visual sensitiveness.

A striking contrast immediately becomes apparent if one con-
siders the many domestic areas of the past with the typical American domicile of the past century. In Kahun there is a strong indication that residential areas of the pyramid workers are composed of repeated standardized units, although of a low standard. It is difficult to say that this repetition and unity was largely the result of visual sensitivity although it may have been recognized. It is more probable that standardization was the result of an expediency to erect a complete town with minimum effort for the purpose of building a pyramid. One might say that standardization in Kahun was largely because of the social and economic situation.

All through the annals of history the same tendency to standardize can be noticed to varying degrees and because of varying reasons. At no time can one really say that it was primarily the result of a visual sensitiveness as many would like to believe. To the contrary, it is more likely that the visual advantage or disadvantage was realized after other stimuli had pointed the way.

It is in Europe in the last century or two, that a general uniformity of domestic structures is most apparent. Again its cause must be attributed to many factors - regionalism in form and material, various forms of government, prevalent economic structures, and to some extent possibly industrialization is a factor although its full impact is yet to be realized in the building industry. A survey of typical residential areas in Germany, Sweden, Holland and England, for instance, reveals an astonishing uniformity within defined areas.

It has been pointed out that Mannheim, Germany is uniform to
the extent that the whole residential area appears to be under one roof. In Europe therefore the obvious visual problem has been one directed toward achieving variety.

In the United States, considering approximately the same period of time, there has been in general a noticeable lack of this uniformity. Our upper class residential areas in particular are characterized by what seems to have been a conscious attempt to make every domestic structure as varied in every respect as possible. The problem of the townscape artist here has been the exact opposite of those in Europe -- that is-- to achieve unity by every possible method. This has been attempted with the use of trees, fences, etc., in an attempt to unify the incompatible quality of our houses in the street picture.

During recent years the pendulum has taken a noticeable swing toward the European uniformity. Today, it seems, that industrialization processes are about to make a more resounding impact on the building industry. We must begin to consider the visual problems which it implies.

It has often been said that pictorial art is of value in pointing to the trends in the expression of shape and form of an age. To the discerning observer it is evident that even pictorial artists have anticipated and accepted the challenge of defying monotony in the use of standardized shapes in a composition. The pictorial representations of Mondrian, for instance, have a self-imposed restriction of standardized shapes in an effort to point the way to a solution.
The Art of Variety:

The problem of visual monotony which is inherent with the use of standardized domestic units must be approached in much the same manner as that of the gridiron as a geometric pattern. The same fundamental principles of composition apply but on a smaller scale. It is involved specifically with areas which are smaller in size but it also registers a considerable impact on the whole complex.

Again the term monotony is inextricably associated with variety, unity, rhythm, repetition, and modifying factors such as color, value, and texture. Again it must be realized that monotony is an excess of unity and that unity is not achieved by repetition of all the basic factors which go to make a composition. Where one element establishes a necessity for repetition it might be gratefully accepted as a base for establishing a unity. In the case of the gridiron pattern, the basic shape of the grid was accepted as a unifier. In considering a residential subdivision the standardized housing unit might be accepted as the element best suited to impart unity. In the gridiron pattern of a city the elements which have been referred to as instrumental in achieving variety are space, texture, large scale application of color, etc. In the residential area, assuming that a repetition of units is one way to achieve unity, variety becomes a matter introducing varying color and texture in fences, plant materials and structures. Add to these the less frequently recognized value of sculpture, monuments and pictorial representation in outdoor spaces of residential areas and one cannot fail to be overwhelmed with the potential variety and interest which is
capable of being expressed.

An article in the Architectural Review emphasizes that the products of the artist have not yet found their proper relationship with the people.

"Painting has long ceased to be a public art; the remedy say some is to commission painters to decorate interiors of public buildings. But public buildings in our civilization of paradox, are not much frequented by the public. Isn't there a better case for turning painting out of doors, into the most frequented place of public assembly, the street?"  

It must be recognized that here also, that too prolonged a repetition of any standardized unit will produce monotony. Therefore, to take a rather absurd example, if a city of a million people were housed in identical detached units it would be very difficult to imagine anything but monotony in spite of every effort to alleviate it by other means. This example it would seem is extreme because it is difficult to conceive of such a condition existing at any time as a result of industrialized standardization, even at its zenith. We can probably anticipate a considerable degree of variety in industrialized housing as it is apparent in the automobile industry. To accept this would mean another source of variety with some far-reaching design implications.

Although many are apt to think that the use of a standardized unit implies a strict uniformity in project appearance, Burnham Kelley points to another potential variety which has more impact. Speaking of project variety he says,

"The industry (prefabrication) will gradually grow away from the tendency to seek variety through the application of exterior materials, details, and finish treatments to identical houses in the hope of giving the appearance of that random collection of structures which has characterized our neighborhoods of the past. The results obtained by these are rarely pleasant, and often achieve only what William W. Wurster has called 'the monotony of slight variation'. More important in the future will be variations in color, in placement of houses, in arrangement on the lot and street line, and in relationships with garages and other structures -- a variation which obtains its quality from a frank recognition of the basic similarity of the houses involved."

This must be recognized as a potential source of variety which considered in itself is tremendous in scope. However, to facilitate good orientation with respect to sun etc. it will be seen that a very flexible arrangement is necessary. Thus, not all standardized houses would be equally suitable to this type of variation. At this point it can also be envisioned that too varied a juxtaposition of basic units in this way might lead to varied chaos. It would seem that a visual order must be achieved with restraint.

It is not necessary to deal further at this point, with a more detailed study of the application of these visual principles, as related to a standardized unit because they will be discussed and illustrated later. It has been the intention only to focus attention on the general nature of the problem.

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THE NATURE OF SPACE

The Superlative Design Element:

A discussion of the basic art principles - unity, variety, contrast, etc. - has been indulged in with respect to gridiron as a pattern and the domestic structure as a standardized unit. Of deeper significance however, is the consideration of unit spaces and their compositional interrelation because all three dimensional designs consist of space or a series of spaces. Space is perceived by the individual in a subconscious way. It is only with some effort that man can analyze and perceive it consciously. Therefore its importance as a design medium has been too often overlooked. But even to accept this fact, it seems that to design comprehensively and with an objective to stimulate human emotion, one must study and consider space consciously although it is perceived subconsciously.

The standardized housing unit is only one of the elements which can be used to define, delimit or modulate space. There are a host of others but they are all concerned with space enclosure. They are mere parts of a spatial composition. Furthermore, the total urban complex, whether of a grid pattern or some other type, is composed of many unit spaces. It is however, true that both the housing units and the gridiron as a pattern may profoundly effect aesthetic quality of resulting spatial composition. It can be recognized at this point that unit spaces and their interrelationship are really the most comprehensive elements of
any three dimensional design; that analyzing the visual qualities of space is the essence of the problem, and that it must be studied in considerable detail.

The Two Characteristics of Space:

Erno Goldfinger has discerned two obvious but intrinsic properties of space—its quantity and its quality. The quantity of space as treated by Goldfinger is concerned with the size, that is the amount or volume of enclosed space as perceived by man. The quality of space, although it is profoundly affected by the quantity, is chiefly concerned with the degree of spatial enclosure, the quality of the enclosing agent, and quality of the space enclosed by that agent or agents.

After thoroughly investigating the visual nature of the quantity and quality of space it would seem desirable to analyze how a number of spaces as component elements of a total composition can be treated to relieve monotony, produce contrast and variety, achieve beauty, and in a general way, produce a more satisfying and stimulating visual environment.

There are three aspects of space which the designer must thoroughly understand and become familiar with as working tools.

1. The quantity of space, and the way in which a quantitative

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1. It would be desirable to use the more inclusive term sensory qualities, because visual perception is only one of the sensory perceptions which contribute to the human sensation of space, but the total subject is too great to be treated here.

"A person enclosed by the celestial sphere and the imaginary line of the horizon experiences the least enclosure imaginable within the limitations of our planet."

Figure 16.
"Completely enclosed but the size of the enclosed space becomes an important factor. A quantitative increase causes a qualitative change."
increase or decrease effects the quality of space.

2. The quality of space - that is - the quality of the enclosing agent and the component parts defining or occupying a space and the quality of the space enclosed by the enclosing agents.

3. The artistic manner in which various spaces of different quantity and quality are composed with relationship to each other.

**Space Quantity and Enclosure:**

At this point it is necessary for a sound basis of further discussion to briefly summarize the three articles of Erno Goldfinger on space.

A space regardless of its quantity or size must be enclosed. Therefore enclosed is the first and most fundamental characteristic of space. The difficult thing is to realize what the enclosing element is. Goldfinger points out that there is really no such thing as zero enclosure as far as man's perception of space is concerned because of gravity and the existence of air pressure etc. If a man were standing on a limitless expanse of flat desert terrain one might be inclined to say that this represents a total lack of enclosure. Really this is not true because a person is enclosed by a celestial sphere. The imaginary line of the horizon is instrumental in defining it. However it can be stated that this represents the least degree of enclosure possible on

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Fig. 17. A person surrounded by the imaginary barriers of a pattern.

Fig. 18. The barrier is more tangible but the sensation is still mainly suggested.

Fig. 19. The barrier is real.

Fig. 20. The size of the barrier is another of the components which influence the intensity of the spatial sensation.
our planet even though it is not really zero enclosure.

At the other extreme it is valuable to determine the 100 per cent enclosure—the point at which enclosure is most tangible and easily recognized. To use Goldfingers examples, this can be shown by imagining that a person is completely encased in casting of plaster-of-Paris, enclosed in a coffin, or inside a cavern with no opening. From the foregoing examples it can be seen that the size of the enclosure varies, and this makes considerable difference by way of a physical hindrance to movement (as in the first two examples) and the sensation of enclosure.

From the examples just discussed and the illustrations herein included from Goldfingers first article it can be seen that the quantity of space is governed by the size of the enclosure and the properties of the enclosing element— that is, the degree of enclosure which is possible when different elements are used to enclose space. Although it is recognized that the quantity of space cannot be discussed without considering the properties and disposition as well as the quality of the enclosing elements or elements\(^1\), it is the size of the enclosure to which attention is directed at the moment. The properties of the enclosing elements are more qualitative than quantitative and therefore will be discussed under the "Quality of Space".

The size of the enclosure implies dimension of width, breadth

\(^1\) The properties of the enclosing element must be considered quantitatively because a glass enclosure gives a visual illusion of greater space than if a space of the same size and shape were enclosed with an opaque material. Also if Fig. B defines the same space as Fig. A, the first will be visually larger because it is less rigidly defined.
and height. These in addition to having functional or utilitarian consequence must also be considered for a visual impact. This involves the consideration of scale, in the visual sense of the word. First one must consider an isolated space as an entity in itself. Varying the proportion and size of space with relationship to the size of man has a definite psychological and emotional impact, as well as a visual impact. A space which is large in scale or size may have the effect of making man feel insignificant or subservient such as the feeling which is evoked in the large monumental scale of the formal French gardens and the large interior spaces of Gothic cathedrals. This feeling is achieved (there are other factors which contribute to it) by a large dimension in breadth, width, or height or all three. Smaller spaces on the other hand make man feel more significant, cozy, secure, and so forth. There is no exact line of demarcation in size and it is probably not important to determine. The foregoing examples are not meant to imply that large scale spaces are only capable of evoking a feeling of insignificance in man, because the varying of size of space is probably much more significant than that. The important thing, it would seem, is that the changing of scale and size of spaces is capable of evoking many varied visual, psychological and emotional reactions.

The Quality of Space:

The scale and volumetric size of space has been mentioned as important in the consideration of quantity, but it is also in a manner of speaking a qualitative thing. A space may have the quality of good or bad, scale for instance. It may have the quality of size which will
facilitate movement or easy communication, and it may have a quality of a satisfying or dissatisfying proportion. These are three qualities which are dependent on the quantitative aspect of space.

The elements of scale and size have been considered. It is also necessary to discuss proportion—that is, the visual proportion of width, breadth and height of a space entity as related to man. Many dogmatic rules for satisfying visual proportion have been expressed through the ages and many are in violent discord. It seems likely that no rules can be definitely established because its consideration will inevitably vary with the situation and the sensations which are intended to be evoked. For example a straight street space 1 mile x 50 ft. defined by buildings on all sides, a terminal feature at one end, might certainly be called a space of bad proportion, but it does an intended job if a monumental emphasis is achieved for the terminal feature. This is not to say that a sensitiveness to good proportion is not essential to the design of space and that it is not a factor in considering space quantity, but a more detailed treatment of the subject cannot be afforded in this thesis.

The quality of space is however largely determined by the degree of enclosure and the qualities of the enclosing elements. To consider first the degree of enclosure it can be recognized that a space can have the quality of enclosure to a high degree or to a degree which is much less. Goldfinger's sketches illustrate this. Now to relate this to what can be called a residential space-scape it can be imagined that in Fig. 17 the circular area is a ground texture of cobble stone which
Fig. 21. The shape of the enclosed space is among the geometrical properties which have to be considered.

Fig. 22. The scale of the enclosure influences the comfort and aesthetic appreciation of the enclosed person.
gives a feeling of imaginary enclosure and only to a very small degree. In Fig. 18, if the posts become houses or trees the quality of higher degree of enclosure is perceived. If in Fig. 19 one imagines the circular brick wall to be a series of adjacent buildings forming a court without openings the quality of enclosure is present to a high degree.

It has often been thought that only the degree of enclosure manifested in the last sketch is of use in the townscape to define space—that the higher the degree of enclosure the better the space and that the case illustrated by Fig. 18 is a condition to be resorted to only if more complete enclosure is not possible. It would seem at this point however that all the degrees of enclosure are of value in their proper place, and that a particular situation will give some indication as to degree of enclosure from both a visual and utilitarian point of view. However, from a visual point of view it cannot be denied that the higher the degree of enclosure the more intense is the psychological, emotional, and visual impact, but fortunately for the sake of variety this high degree of enclosure is not easily achieved over a large area by those who wish it, for it would cease to have the same impact if all spaces were such.

It will be noticed that up to this point most of the spaces indicated in sketches have been circular or cylindrical in shape. Obviously this is not always the case. This fact would lead one to recognize that the geometrical properties of shape are a quality of space. Fig. 21 on the opposite page indicates two different shaped spaces with two different spatial qualities.
The properties and qualities of the enclosing elements also play an important role in producing space of various qualities. (It has been found that it is difficult to differentiate between a quality and a property of some elements and no attempt will be made to differentiate between the two terms here.) The all-inclusive nature of space as a dimensional design medium can be recognized when one realizes that the color, and texture, the degree of transparency or opacity, and the size, shape and dimension of the enclosing elements, whether they be vertical elements such as trees, structures and fences, or the horizontal elements such as the floor or ground and the sky vault, are all factors which contribute to the quality of space.

The Interrelation of Spaces:

To be concerned with only the individual spaces in themselves as has been the discussion thus far, would be a serious error. Because spaces do not exist only by themselves but, they invariably have a high degree of interrelation. All of our environment is composed of very complex interrelation of spaces whether it be in nature's landscape or the man-made townscape. One space always leads into another and those into still others, or a small space or series of spaces may be contained within a larger space and so on. Spaces must be considered as interrelated because spatial visualization is not static, but dynamic as far as man is concerned. This is so because man is a mobile creature. The range and speed of his movement has increased from time to time so that now it has become an extremely complex spatial consideration. The way in which space is visualized depends on the position or locus of positions of the person in the space.
If man were a stationary object incapable of movement but yet could perceive space in a $60^\circ$ cone of vision it is doubtful whether space as a sensation could be perceived by him. Certainly his visual experience would be lacking in variety unless of course the objects which his vision intercepts were in motion and therefore changing. But to go one step further it can be imagined that a person is mobile only to the extent that he can turn around as if on a turntable. In this case there can be no doubt but what space can be perceived. If the space is completely enclosed, however, that person could perceive only the space which he is in and there would be no need to consider an interrelation of spaces. His spatial perception would be varied but only to the extent that he could see the different portions of the enclosing element and certain inequalities in the shape of the space. This focuses attention on an interesting point. Only a limited part of a space can be visualized at one time — that part intercepted by a $60^\circ$ cone of vision. This accounts for the use and existence of spaces with only three sides enclosed. A person looking at the closed end of such a space perceives the same amount of enclosure as if the other side were enclosed also. From an instantaneous point of view this is true but this statement fails to reckon with a very important aspect—the perception of a spatial order. Goldfinger points out that "we have no special organ for registering a spatial sensation; the awareness in this case is subconscious and takes place by the automatic registration of successive images and by the effect of memorized analogies....Memories and experience, not only of visual sensation but also of sound and touch and smell,
enter into it." It seems apparent then, that the memory of the lack of enclosure on the fourth side will be perceived because of the experience remembered upon seeing the fourth side in a succession of images.

Let it be, at this point, imagined that man acquires a sudden increase in this degree of his mobility, to the extent that he can move not only in a two dimensional direction on the ground but also in the third direction - up and down, and at varying degrees of speed. With this added degree of mobility, which of course we have in reality, it becomes apparent that our spatial perception and visualization becomes a very complex thing to deal with, and that many new aspects on one space, and many other interrelated spaces, come in view.

Now if one admits that the nature of space, the way in which it is visualized and perceived, and the sensations which can be evoked in man by various qualities and quantities of space, is really the all-inclusive design element it seems necessary to treat a composition of spaces according to the fundamental principles of art also.

There can be unity variety, balance, and monotony, harmony, rhythm, contrast, order, etc, in design where spaces are the considered compositional elements also. It is possible to have a monotonous space composition as well as a monotonous composition in linear pattern. If for instance repetition of a number of spaces identical in every respect is carried on too long, monotony is an inevitable consequence. As before an excess of unity must be counteracted by variety and contrast.

It is when considering space that the ultimate in variety can be achieved because of the many and complex methods of varying the spatial sensation by changing both the quantity and qualities of space. It is the variation or contrast of spaces arranged along a route of established movement which has the greatest significance. It can be seen that by superimposing an interesting spatial pattern over a grid pattern of circulation a total composition of urban environment might be achieved which would defy monotony.
7. PRINCIPLES OF UNIT SPACE DESIGN APPLIED

"From the point of view of the town, the individual building is a mere brick in the spatial order of the street or square."1

"One practically wants to find oneself in a beautiful room, one whose walls are formed by the principle buildings while the other walls......they may be buildings, colonades, tree rows, hedges......make connection with the monument."2

Street Spaces:

Although the street space is vitality interrelated with the architecturally enclosed space of structures in a very real sense, and although street space with its spatial appendages is only one element of the spacescape, it seems logical to direct undivided attention to it at this point because it would seem to be the crux of the problem as it is approached here.

It is hoped that what follows by way of an attempt to exploit some fundamental space principles in the urban residential street, will give an insight to the broader applications when and where they are suggested. Certainly no pretense can be made that the application of space principles here represented is by any means complete because the scope of its considerations is truly staggering.

Shape of Enclosure:

The residential street space manifests itself entirely too

often as a long continuous space quite regularly defined on both of its sides with uniformly aligned buildings of a varying nature but occupying their position only by accident. It is only by a stroke of fate it appears that any variety in the streets spatial composition is achieved, such as the existance of vacant lots and the occasional structure which is noticeable for its non-conformance in some way or other. The street has too often been thought of as an elongated continuous space rather than a series of defined spaces. But it can be seen that a street of any kind need not be either regularly defined by uniformly aligned structure or need it be a elongated and continuous space.

**Vacant Lots:**

Probably the factor which is most responsible for the unvarying shape and size of our residential street spaces thereby creating monotony is the "protective" zoning ordinance which impells a uniform setback from the street line. It's original intention was to protect the individuals rights to light and air but to many it has come to mean that it protects to the extent that it preserves beauty—that uniform alignment of structures is essential to beauty. At some point regularity may contribute to beauty but it needs a contrast or variety to prevent monotony. At a certain point spatial appendages are necessary to create variety in the size and shape of interrelated spaces. The vacant lots which dot our residential areas because of some freak in real estate marketing play an important role in providing this kind of spatial variation. However, because of the unkempt quality of many of these their true visual potential is not realized. If such lots could be
Fig. 23. Overlaid space pattern.

Fig. 24. Existing space pattern practice.
cooperatively owned and maintained, or city owned and maintained they could be a very valuable contribution to the townscape.

The Street As a Space Definer:

It must be recognized that streets or routes of circulation in some form, establish a backbone, so to speak, for spatial organization. It need not be a rigid imposition on space formation. When space is defined by buildings such as houses in the typical American residential area the only restriction it imposes is a necessity for pedestrian and vehicular access to those structures. Although one cannot ignore the very real quality of streets in defining space by way of its floor texture and moving traffic, it is of relatively minor strength when compared with the use of trees and structures in defining space. One approach to solving the visual problems of the street space seems to be in making an effort to negate the street as a strong spatial element. Fig. 23 shows how this can be done by overlaying a spatial pattern or composition on a street. Here the street becomes of minor importance in the space composition compared with today's practice in Fig. 24.

Unit Street Spaces:

In approaching the street space with respect to its continuous space nature another method of treatment which overlaps the foregoing to some extent is possible. It has been consciously employed many times in the past but seems to have been ignored in our technical age of

must be divided into a number of unit spaces. They mention several ways in which this can be achieved.

1. Making changes in cross section or inserting plazas
2. Using entrance gates.
3. Utilizing changes of level.
4. Jutting out masses at corners or intersections.
5. Using high towers in the middle of a block.
6. Using arches or overhead elements across streets.

These are devices which are intended for use in a straight street. Figs. 25, 26, and 27 illustrate some of them. This, however, is not to say that the long street vista should not be used. There are many occasions where it may be of considerable value.

**Visual Properties of Curved Streets:**

When this aspect of street space is isolated it indicates a basic difference between curved and straight streets with respect to their visual appeal. Illustration #28 shows that because of its nature the curved street automatically segments the street space without depending on the methods shown by Hegemann and Peets. It has often been held that the reason curved streets are more interesting is that the focal point is constantly changing, but it would appear that few realize that the subconscious spatial perception of unit spaces in curved streets contribute to their visual quality. Certainly both qualities of curved street spaces contributed to its aesthetic appreciation. The important point to recognize is that there are several ways to accomplish
unit spaces in streets without having to resort to curvature and that spatial units probably are a primary requisite to interesting street spaces because as has been pointed out it is the contrast and variety in space sensation which is important.

Since the subject has been introduced and since an application of the property of geometrical shape in space design has to be made it seems opportune to discuss the qualities of curved street space in more detail at this point. The curve has one inherent fault, if one chooses to call it so. It emphasizes the concave side of a street and neglects the convex side -- that is to say that attention is always focused on the concave side because its elements form the constantly changing focal point or terminal feature, while those structures on the convex side are seldom seen without a conscious effort to see them. This condition is exaggerated as the curve becomes smaller in radius. In a broad sweeping curve the effect is not nearly so noticeable because the street in effect is straight to the observer and the curvature only tends to define a series of unit spaces.

**Terminal Features and Focal Points:**

One must differentiate between the use of a terminal feature or focal point and an element used as a device to achieve enclosure of a unit street space. The terms "terminal feature or focal point" infer a selfishness in demanding attention--that is they must be of such a nature that they hold the attention of the observer for a prolonged period of time, and divert attention from the elements along the sides of the street. An enclosing element need not have this property of
demanding attention though it may have. It may be just another simple element which forms one side of the enclosure. In this case much more attention to the elements on the sides will be achieved. Then the actual focal point of the whole street space may be located at any point along the sides in a less dominating position and more may be achieved by way of minor points of interest. It would seem that in a situation where a space is lacking in either a strong focal point much more interest must be achieved in points of interest along the sides of streets to divert attention from the lack of an interesting image at the end. Conversely, if a stimulating focal point exists, an effort should be made to relegate incidental images to their proper place.

**Degree of Enclosure:**

In our contemporary urban residential areas we have become more conscious of the psychological aspects of increased light and air than the visual aspects of a high degree of enclosure which characterizes many residential areas of the past. In a sense the physiological requirements seem to be in opposition to the visual requirements. One would impose a loose type of enclosure and the other, varying degrees of enclosure from one extreme to the other. It has been mentioned previously that a contrast in the degree of enclosure between various spaces is a basic way to achieve contrast and variety of visual experience. If a lot of space between houses is a general requirement over a large residential area some other enclosing element must be used to achieve the higher degree of enclosure.
The New Role of Trees:

It is at this point that one is forced to look for space defining elements of different quality. Those that will provide a higher degree of enclosure without infringing on the individuals right to light and air. One of nature's elements of space enclosure -- the tree specifically, and plant material generally -- can assume a new role of importance in spatial composition. When skillfully handled by the landscape designer it would appear to have the ability to enclose space in many varying degrees without an infringement on optimum light and air. On the other hand, plant material is often instrumental in controlling light. The tree is its infinite variety of forms and properties when combined with other types of plant material fences, etc., are all tools of the landscape designer for enclosing space.

The result of a historical survey with particular attention to the use of trees, would indicate that there has been a notable absence of the use of trees in the townscape during times when a high degree of enclosure was achieved by closely knit buildings. Many of the spaces which we admire today such as the San Marco Plaza in Venice and Palace Royale in Paris have not a single tree in the enclosure or defining the enclosed space. It is only when a lack of structures as elements in enclosing space is prevalent that trees become important. This seems to be our situation today.

It is often recognized that trees and plant material have an important place in our contemporary residential area but their role has

1. The term "landscape designer" is used in the sense that a landscape designer is really a space designer. Plant materials, fences, etc. are merely his tools in defining space.
Fig. 29. Dense growth from top of trees to ground.

Fig. 30. Uniformly spaced trees that have a pillar-like quality.

Fig. 31. Trees with long trunks giving a limited feeling of enclosure.
been chiefly one of lending superficial decoration, providing shade, etc. Their value as spatial enclosure has not been fully recognized or exploited. The need for providing shade along streets has led to the universal practice of lining each side with street trees for mile upon mile of urban streets. It is true that this practice has been instrumental in providing a very unique spatial enclosure and its visual potential has been recognized by many for centuries, but even the exciting sensation of movement under a canopy of foliage must soon become monotonous if continued for too long a time. It would seem that much more imagination and ingenuity could be used in the composition of trees for a spatial impact.

Figs. 29 through 31 are intended to show how trees might be used to enclose space in a varying degree when structures are uniformly spaced at a considerable distance so as to eliminate their value in achieving a varying degree of enclosure. They indicate several ways in which the vertical planes of an enclosure might vary in degree and quality. Fig. 3 also shows that different sides of an enclosure may have different qualities by using different species and introducing hedges, etc. It can be seen that much variety is possible.

Obviously the role of trees in defining a vertical plane can be augmented by their use in defining a horizontal plane, that is a ceiling to outdoor space. When used in a combined way the tree becomes a versatile tool for the space designer. Fig. 32 shows how a completely enclosed space might be achieved with plant material when used in an architectural way. Imagine the outer edge of the pattern to be dense
evergreen growth from the ground to its full height and the trees in the center as having long trunks and dense spreading high foliage. Then one would have a completely enclosed space, except for what transparency is present in the lacy nature of the foliage. This is an extreme example but it is useful in that it illustrates the potential of plant material in enclosing space.

De-emphasis of the Street with Trees:

It is conceivable that plant material can be used to de-emphasize the street as a space defining element rather than serving to emphasize the street as has been done so often in the past. One cannot neglect the utilitarian value of having shaded routes of circulation but a visual contrast is also necessary. It would seem that some compromise must be considered. In residential areas where pedestrian circulation is only necessary on one side (or not at all in schemes such as Radburn, N. J. and vehicular circulation is light) one might settle for trees on the side walk side and intermittent areas of foliage in opposition of the street. This is not to say that the street as a tree arcade should have no place, but it must be relegated to its proper place in the composition.

Space Considerations for Throughway Design:

In considering the composition of space as related to the throughway or arterial street which handles heavy traffic, the problem is of quite a different nature. Not the least of the considerations here is the increased speed of movement but this will be discussed later. Practical and utilitarian consideration would make a considerable
case for a zone of little or no habitation for a considerable width paralleling the right of way. This should not mean however, that it need be devoid of an interesting spatial organization. The application of the fundamental principles of space hold here also, but as will be seen later, must exist at a larger scale. In such an area desirably void of structure the spatial experience must to even a greater extent depend on the use of plant material and changes of level. Those traversing these routes of movement should also experience a stimulation in street space, units varying in degree of enclosure and size, color, texture, etc.

Time does not permit a detailed analysis of the visual problems of through way spaces but one important point must be mentioned. Although this thesis is concerned with urban space on level terrain man-made changes of level play an important role. The congestion and complexity of urban traffic has motivated a solution which involves intersections of two and even three levels. The nature of the modern through way provides a very positive method of dividing it into street units and at the same time providing a degree of variety by the introduction of these levels in contrast with one another. Fig. 33 shows how street units are inherently achieved by intersection changes of level. It also suggests what might be done to create more interesting spaces. Fig. 34 shows how a contrast in level might be integrated with the inherent visual stimulation which is created by most grade separations. It might well be asked how these aesthetic values can be achieved in a design process so completely belonging to the engineer technician, and, furthermore, are not some of the
Fig. 38. The Framed Sky
The infinity of the sky gives a feeling of a vast sea beyond.
enclosing device
Space defining elements can be an effective

Fig. 30. Depression when used alone or in combination with other

expansive retaining walls
Sculpture in residual earth which does not require

Fig. 33.
proposals of the aesthetics impractical from other points of view?
To this one can only offer the answer previously quoted by Hegemann and Peets on page 60.

**Minor Man-Made Changes of Level:**

It is well to recognize the visual qualities of grade separations but with thought and imagination the space designer can achieve an accent of the effects. One might, for instance, achieve the effect of a "framed sky" as illustrated from the Townscape Casebook\(^1\) (Fig. 30) by a planned composition of trees at these spots which are usually barren. It would also serve to emphasize the effect of pressure on the lower level.

To realize that changes of level need not be entirely lacking on level terrain is of significance in residential areas also, though on a smaller scale. It has been recognized that even a pattern of texture on the ground is capable of defining a somewhat imaginary spatial enclosure. The degree of enclosure which man-made changes in level on flat terrain can achieve is not high except in extreme cases, compared with elements of defining enclosure such as trees structures, fences, etc., but it is none the less worth considering. It has too often been the practice that where excavation and minor cutting is necessary the resulting residue is hauled away or deposited in a spread out manner to retain a relatively uniform levelness. Figs. 35 and 36 show two basic ways in which a change in level can be used to define an imaginary enclosure without a very great expense.
Plastic or Flowing Space:

It is important in discussing the degree of enclosure to be cognizant of the recent discoveries in Architecture that the enclosure of space need not at all times be a rigidly defined volume but that it can be a plastic or free flowing thing. To compare the very tight enclosure of a room or house whose only relation with the adjacent spaces is through small constructions called windows and doors, with its often cited opposite, Mies van der Rohe's Barcelona Pavilion will make the point clear. It is the variety in the degree of enclosure, which the unlimited number of materials at the exterior space designer's disposal, that is of significance here. The plastic or flowing space need not be of sole significance in architecturally enclosed spaces. It will be seen that the various degrees of spatial enclosure have a considerable impact on the strength of the interrelation of different spaces in what is termed "vistas" of different types and that the plasticity of a spatial composition is directly dependent upon the qualities and disposition of these elements of enclosure. Figs. 39 and 40 illustrate this type of space.

In these illustrations there is still a great deal of dependence on enclosure since according to the original definition space cannot be space without enclosure of some kind. The major difference between these and the more rigid and regular spaces previously illustrated is in the way they are related to adjacent spaces. A plastic space composition depends on the use of imaginary lines and planes, and enclosing elements which define a space without obstructing a visual penetration.
into adjacent spaces, as well as being a composition of less rigidly disposed space enclosing elements. Both of these factors contribute toward its flowing or plastic quality.
Fig. 41. Enclosure

"Enclosure is one of the most important aspects of civic design, quite apart from the character of enclosure, whether it be formal or intimate, medieval or modern, there is the sense of internal pressure.

Fig. 42. Exposure

"The converse of pressure is release. The grasp of relief is more enhanced when the activities externalized are those previously associated with the world of the interior."
Spatial Variety and Unity:

Up to this point in application of space principles to residential areas the emphasis has been on considering unit space enclosure for their individual visual qualities. This is certainly important because man often occupies one space for considerable periods of time. Therefore each space must be capable of achieving a good quality both visually and functionally and maintaining interest over a prolonged time span. But it is in the contrast of different qualities of various spaces in the whole composition, without sacrificing a spatial unity, that the visual problems become most complex and hold the greatest potential in stimulating human emotion.

Variety and Contrast in Size:

Probably the most basic and most obvious contrast to be achieved in a composition of spaces is that of varying size. Figs. 41 and 42 from the Townscape Casebook\(^1\) indicate in broad way how two complete opposites of space enclosure if adjacent to each other in a composition can be contrasted. They are of course varying intermediate degrees of this same contrast. In a residential area proper, the large degree of contrast is seldom possible because economic considerations of density are opposed to it. But it will be seen later how a considerable contrast in spatial size can be achieved between areas which are predominately residential by introducing other spaces of a more loosely knit quality.

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\(^1\) Townscape Casebook, Op Citc, P. 365.
Fig. 43 attacks the problem using residential structures and fences to achieve a contrast in size of spatial enclosure on a much smaller scale. At this point let it be imagined that all of the structures are one story standardized units and that all the fences are opaque, 7 ft. high and uniform in every respect. Here the size of space varies in a two dimensional way by enclosure and release of space defined by structural volumes and planes.

In Fig. 44 the use of trees is relied on to define spaces along a circulation route without consideration for the other space defining elements which might be used. At this point it is convenient to imagine that all of the tree growth indicated is of dense foliage from the ground to its full height and is of one specie. It might be evergreen, for instance, in which case it would form a dense vertical plane.

Now if the tree spaces are used in conjunction with the spaces defined by the structure, to bring the example closer to its practical application as in Fig. 45, it can be seen that there are two different space sizes which are co-existent and inter-related forming a double contrast which can either complement or oppose each other. It should also be noted that only two basic sizes of spaces have been used. Obviously many more different sizes and shapes can be used to achieve a far more varied composition if the whole is large enough to merit it.

**Varied Degrees of Enclosure:**

At this point it is necessary to infringe on what is rightfully a degree of enclosure but it is also a matter of size. It can be recog-
nized that the foregoing illustrations do not define a ceiling to the space except to the extent that one can visualize the imaginary plane which is formed by a uniform height of the vertical planes. If one does not imagine this, the ceiling is defined by the infinity of the sky vault. It is possible and practical, however, to define ceilings of residential spaces in more real elements. The most practical method is by the use of trees which have the proper shape. The previously illustrated sketch (Fig. 32) gives the clue here. It can be seen at this point that the contrast between the size of the spaces in Fig. 44 would be intensified if at the points marked "enclosure", an umbrella of foliage were added to define the space ceiling.

Before going further—that is to show how some other qualities of different spaces might be varied or contrasted to achieve visual interest and emotional stimulation—it seems necessary to recognize that some uniform quality or characteristic might be desirable in effecting a strong unity. It is true that the street is a unifying element in itself and that in the example which will be shown the structures of a uniform size and shape in the composition will also tend to unify the composition. However for the sake of illustration it is convenient to assume that more unity is necessary (it is doubtful that it is) and that again the use of two basic sizes of space will achieve it. Although these three are used specifically here it should be realized that any one or combination of several characteristic properties common to a group of spaces could be instrumental in achieving unity.

With the foregoing restrictions it is possible to use the basic framework established in Figs. 43, 44, and 45 for the purpose of ex-
ploiting a maximum of variety.

Now to deal with the three spaces in Fig. 43 again, a variety of size has already been established. There exists two spaces of the same size and shape, and a contrasting space between them which is considerably smaller and more restricted. If the central space is left as it is, it would seem valuable to achieve as much variety as possible in the larger spaces adjacent to it.

If one is concerned only with the fences, it can be seen that by removing the fences altogether in space 1, the degree of enclosure is markedly diminished. An altogether different spatial sensation will be felt between spaces 1 and 3. In space 1 there will be a high degree of visual penetration into adjacent spaces. At this point the space will undoubtedly seem larger because the eye will look for new barriers which are further distant to close the gaps where the fences were. Fig. 46 shows the new space in this case. At this point a variety in degree of enclosure also effects the size and shape between the two large spaces.

Now if one again uses fences in space 1 as before but makes them all wire fences with visible supporting posts, then the degree of enclosure is again changed. More enclosure is apparent than existed with no fences, but considerable less than when the opaque barriers were there. The wire fences form a very real barrier where in the previous instance the imaginary plane formed by the alignment of buildings was the only barrier. It should also be mentioned that at this point a variation in texture exists between the fences in 1 and 3. Suppose the original opaque fence were of corrugated metal with its peculiar texture, in
variety and contrast with the wire fence. Of course it would be possible to have a variety of fences, such as picket, paling, hedges, etc. within the first space and have a uniform fencing material in spaces. Then, in space 3, of course, a different kind of variety is noticed. And to carry the example to its illogical extreme the fences of different texture could all have different properties of color, the color in space 3 remaining uniform.

Miscellaneous Varieties:

The same process in effecting variation could be followed in dealing with the trees or the structures, the ground plane, or the ceiling plane in achieving variety between spaces but further pointed illustration would seem unnecessary because the process is much the same. The potential variety in the degree of enclosure of trees has already been discussed at some length - one needs only to add the consideration of color texture and form, etc., here. The variety of the structures it would seem is necessarily limited to a variety in color and landscape treatment because of the nature of standardized units. And the subject of floorscape cannot be dealt with in more detail because it would make a thesis of considerable size by itself. For those with a particular interest in a more detailed discussion of floorscape as well as color and texture, they are referred to the annotated bibliography.

There is, however, one other factor which is valuable in achieving contrast and variety in the composition of spaces. It concerns value, or the light and dark quality of space. To fail to recognize
Figure 47. Fluctuation Between Light & Dark
This element heightens the sensation between enclosure and release.
that sunlight plays an important role in the quality of various spaces would be a tragic error. Fig. 47 from the "Townscape Casebook" dramatically illustrates the effect of light contrasting with dark as a person moves through a series of spaces.

It is apparent that a structural enclosure of spaces such as this would not be practical in our contemporary residential areas but the conscious placement of trees along routes of movement can replace them. When the sun is low in the sky vault any vertical form will create extended areas of shadow. When the sun is high, a ceiling cover is necessary to achieve the same effect.

**Transition Between Spaces:**

In dealing with the practical aspects of integrating a group of spaces one must also be concerned with the principle of transition. Transition may be defined as the method which is used to effect the change from one space to another. This may be done in a subtle and gentle way or it may be achieved in a sudden or sharply contrasting way. A gentle transition implies a soothing sensation, while a sudden transition is apt to be jarring and restless. The employment of both types have a place in exterior space design. To generalize, one might say that the majority of transition should be of the gentle type but that an occasional sudden contrast is essential to visual alertness. The sensation one experiences when suddenly emerging at the mouth of a mountain tunnel after travelling perhaps a mile in a complete tunnel enclosure and suddenly being exposed to a vast panorama of mountainscape will illustrate the sudden transition. Fig. 48 illustrates how a gentle
Figure 49. "Screened Vista"
The transition from the space of viewing into the space viewed is defined softly by the lacy screen of foliage and vertical elements.
Fig. 49. Netted Vista.
The effect of netting is to relate, and thus create, detail out of the general. The everyday dull scene ceases to be utilitarian. It becomes a piece of scenery that you are attending to.

Fig. 50. "Vista by Implication"
"The promise which may or may not be fulfilled but which changes the character of a place by the hint of vastness."
transition can be effected in terms of degree of enclosure with respect to a residential area. Similar transitions could also be illustrated using color and texture etc.

Vistas and Transition:

The familiar term vista, is closely related with transition when the size and degree of space enclosure is the primary consideration. Literally speaking, the term, vista, means view, but by usage it has become associated with the manner in which the view is defined, framed, or articulated. Figs. 49, and 50 show several types of vistas illustrated in the "Townscape Casebook". Fig. 38 previously illustrated might also be called the "Framed Vista". It frames the infinite sky and makes a contrast of increased intensity from one space to another. In architecture doors and windows of various qualities form the transition element between spaces. In exterior space design the analogous tools, "Nettled Panorama" or Vista, "Vista by Implication", and "Screened Vista" serve the same purpose. It can be seen that with careful and understanding application, these devices of transition can be used to great advantage.

Effect of Motion:

Erno Goldfinger has succinctly stated the visual effects of motion on space design.

"Two entirely different categories of experiencing the new spatial order will now appear. The one of persons

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1. IBID. 367.
moving up to, say, three miles an hour, i.e., walking; the other of persons moving at a rate of 80 and more miles an hour. If we consider that a normal person can register about 21 separate images in a second, the fundamental difference between the two sensations becomes clear: solid screens become transparent, far-spaced objects come into a spatial relationship, etc. A complete aesthetic revolution follows; the enclosure will no longer be the street and its bordering buildings (i.e., the urban "ribbon development"), the two will be divorced from each other: the street will be at the time-space scale of the new speed, and the buildings and their approaches at the scale of human beings.\(^1\)

When Goldfinger states that "solid screens become transparent" he bares a point which is quite easily overlooked, but may be of considerable significance in the new age of space design. One can quite easily demonstrate this visual phenomenon to himself by performing a simple experiment. Hold out your hand with fingers spread and one eye closed so that it partially obliterates an object in view. With a rapid back and forth movement of the hand it will be seen that the object is no longer partially obliterated but is just about as clearly visible as if nothing were interrupting the vision. It is only possible here to show how this same phenomena exists in urban space and to generalize on its spatial effect. A much more thorough understanding of the variables involved, such as space between objects, rate of speed, distance from screen to viewer, etc., would seem necessary before it could be intelligently applied.

Nevertheless, one walking on a broad avenue planted with aligned trees gets a visual sensation of a high degree of enclosure if wearing blinders to divert vision from the side. However this sensation

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requires concentrated attention toward the distant focal point. If
the blinders are removed so to speak, and the individual is walking
or traveling at a slow speed, a considerable degree of enclosure is
yet felt because when looking from the side, the tree trunks, depending
on their diameter and proximity to each other, will partially obstruct
any distant view focused upon. Now if the speed is greatly increased
the trunks disappear in effect and the distant view comes into un-
obstructed vision. Therefore it can be seen that the effect of motion
can be to increase or decrease the degree of enclosure by effecting a
change in the visual qualities of enclosing elements.

Probably the most obvious impact of motion is its effect on
the scale of spaces, the distance between significant spaces, and the
treatment in detail of them. In rapid motion the unit spaces along the
route of movement must be large and significant spaces spaced further
apart to give the individual sufficient time to dwell upon and enjoy
them for what is intended by way of an emotional and psychological re-
response. Bolder treatment and larger scale of the details of such spaces
is necessary, otherwise they will be lost at high speeds. For instance
small areas of color closely spaced on a plane very near the plane of
rapid motion will fuse together and form different color, largely a
result of mixing. It will be noticed in Fig. 33 that if the space be-
tween intersections here is approximately one-half mile the scale of the
spaces formed by the trees at the side is quite large. On the new time-
space scale they are comparable with the smaller unit spaces in Figs. 43
through 45 which are designed for individuals walking or riding in more
Figure 52.
slowly moving vehicles. A person moving through the latter spaces at speeds over 50 miles per hour would lose most of the impact which is intended. One can say that the small indentations in the latter illustrations are analogous with the larger ones formed by trees in the former. But these variations in space size for both are probably not diverse enough in a broader sense. Within the residential area some larger spaces with more open character would seem desirable at strategic points. The same is true of the time-space scale of rapid movement. Larger spaces of varying quality are necessary to contrast with those in Fig. 33. One method which might achieve this is illustrated in Fig. 52. Here the incidental spaces formed by trees and surrounding residential structures are contrasted with the larger scale space occupied by the schools and commercial buildings.

Goldfinger has established a dichotomy of a sort with respect to probable speeds of movement. 1 He recognized only two general classifications; persons moving up to three miles an hour and those moving at a rate of 80 or more miles an hour. This, he bases on a rigidly enforced system of segregating traffic of various speeds. This categorization however is probably too simple. It does not take into consideration the probability that even in cities of tomorrow certain areas particularly residential areas, vehicular and pedestrian traffic must intermingle. It does not recognize that slow moving vehicular traffic in residential areas at speeds of 15 to 30 miles an hour presents a problem calling for a solution to two time-space scales within one composition of spaces. It

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1. IBID, p.7.
would be theoretically possible to achieve a high degree of separation—pedestrian from vehicular—in residential areas also, if the Radburn scheme were used exclusively, but even here there must be a certain amount of intermingling and certainly there may be many instances where such a solution is not either practical or desirable. The solution to this problem would seem to be first in its recognition and then to design these double space-time scale spaces with a compromising approach—providing for both speeds of movement simultaneously, even if the details at the higher rate of motion may be lost.

The greater portion of this exposition up to this point has been concerned primarily with the thesis that a geometric order need not be monotonous. Considerable effort has been expended in analyzing, according to basic principles of art, what methods of achieving variety can be useful. It remains now to execute a design of large scale for the purpose of applying some of the theories and principles which have been realized and expressed. That is the purpose of Part II.
PART II

DESIGN STUDIES
1. STUDIES TO ESTABLISH A HYPOTHETICAL FRAME OF REFERENCE

Considerable emphasis has been placed on establishing a frame of reference for the area to be studied in detail. Although considerations of time and technical complexities obviously prohibit a comprehensive study of many problems, an effort has been made to put the detailed study in context because it is recognized that areas considered singly often times result in tragic design errors.

It is important to point out that all of the design studies which follow in Part II are intended for application only in cities of reasonably flat terrain, or in parts of cities in which level terrain exists.

Projected Application to an Existing City:

There is considerable evidence to indicate that the much needed opportunity to plan and develop areas for residential subdivision on a larger scale than has hitherto been possible is finally arriving. One important factor which is making this possible is the mass production techniques that have been brought about by the acute post-war housing shortage and the efforts of government and private enterprise to meet this challenging opportunity. This situation has made it possible to plan and execute housing developments of great size, to integrate them with existing patterns and to plan redevelopment schemes in a more comprehensive way. This type of development on a large scale has been of an inferior quality in most instances to date.
The following diagramatic plan of a typical hypothetical gridiron city isolates an area of anticipated residential growth on the periphery of the existing urban structure. It is in such an area that attention is focused.
Areas of anticipated growth requiring subdivision

Diagramatic plan of hypothetical gridiron city prevalent today.
Studies of the Residential Precinct:

The following studies of a residential precinct are not intended as a Utopian scheme because it is recognized that planning at this scale is infinitely complex. But complex and difficult problems can not deter one from attempting a solution. In its original conception it was intended for application in residential areas on the periphery, however it might also be applied in a redevelopment scheme for areas nearer the heart of a city if certain modifications were made.

The term "residential precinct" is used here to differentiate between the proposed scheme and a scheme which was originally proposed by Perry\(^1\) which is called the "neighborhood unit" scheme. They are similar in some respects but have several major differences. Some of the criteria established by Perry, such as walking distances to schools and shopping districts have been adopted, while others have been questioned and rejected. The residential precinct as it is proposed here would cover a larger area than the neighborhood unit. The precinct contains several elementary school districts while the neighborhood unit has only one at its nucleus. The precinct proposal allows more flexibility between school districts than does the neighborhood unit.

The residential precinct scheme accepts a low density and a spread-out urban structure rather than a highly concentrated city on a small area as proposed by Le Corbusier. It would emphasize a rapid vehicular and public transit system to reduce periods of travel time in

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\(^1\) Perry, C. A. "Housing for the Machine Age", pp. 50-82.
in large cities. In the neighborhood unit scheme local shopping dis-
tricts are proposed at thoroughfare intersections, thereby creating an
obstacle to rapid traffic movement. In the precinct proposal shopping
districts are placed at points of access to each precinct unit. This
would be the area of higher land value and would have the greatest busi-
ness potential by reason of its location with respect to daily commuter
traffic of the precinct it is located in and its easy access to through
traffic. This would effectively eliminate non-essential traffic within
the precinct area and it would leave the thoroughfare intersections free
for grade separation which can function smoothly without interference
from shopping traffic.

The size of the residential precinct would be determined pri-
marily by the optimum distance between the bounding high speed through
ways as indicated by a traffic survey for the particular area to be de-
veloped. It is expected that the unit precinct at the periphery of an
existing city according to this criteria would be larger and would have
a lower population density than if the same scheme were applied to an
area which is nearer the city nucleus. As one moves toward the center
of our existing nuclear city structure it is logical to expect a closer
proximity of high speed traffic arteries because of an increase in traf-
ic density. Likewise because of an increase in land value one would
expect a higher population density and a higher ratio of multi-family
housing types -- apartment buildings and row houses -- than in peripheral
areas where semi-detached and detached units would predominate.

Emphasis has been placed on a flexible and interacting social
structure in the physical organization of building types and social elements within and between present areas. This has been done in several ways:

1. By strategically placing social elements such as parks, playgrounds, schools and community buildings for social interaction rather than social isolation in cliques.

2. By locating different areas of varying residential building types so that they focus on two or more social elements, i.e., Detached units do not all focus around one school or park and apartment houses around another. Detached units, apartment units, and row house units are interspersed to focus communally around such social elements.

3. By mixing building types within an area—that is—mixing rows and detached units, etc. within the same block.

4. By keeping areas defined by artificial boundaries such as high speed through ways as large as possible and providing strong visual and circulation interrelations between the precinct areas. Large scale pedestrian grade separations at strategic points are used in this case to achieve this. Through ways on continuous elevated bridges, superimposed on a homogeneous residential pattern would achieve a maximum of this visual and physical interrelation but in most cases it would not be practical.

It has been discovered that the mixing of building types for social reasons has a considerable visual impact. An indescribable
mixing of different building types has been discarded in favor of a scheme of ordered mixing which could achieve a stimulating and exciting visual and emotional sensation in large scale space texture if properly executed and aesthetically zoned. With aesthetic zoning as a tool sudden contrasts between areas of detached dwellings and apartment house units, as well as a more gradual transition from detached to rows to apartments could be largely controlled according to a comprehensive visual design conception. ¹

Design Criteria:

1. Optimum size elementary school district should serve 6000 people, or about 1900 families based on 3.1 persons per average family adjust ratio of building types around one school to achieve this.

2. Maximum walking distance from any residential unit to a grade school is 1/4 mile.

3. Maximum walking distance to local shopping center is 1/2 mile.

4. Minimum of 20 acres of aggregate park and recreation space for residential area of mixed building types with 6000 people

5. Minimum area for elementary school grounds is 10 acres.

6. Maximum walking distance to a major park area should not exceed 1/4 of a mile.

¹ Time does not permit more than a diagramatic expression of a personal conception of an orderly mixture of building types, but it would appear to be an interesting subject for further study from a visual point of view.
Legend:

- Residential
- Commercial
- Schools
- Churches
- Local Parks
- Etc.

*Circles indicate social interaction between schools and parks.*
Legend

- Residential
- Commercial
- Schools
- Churches
- Local Parks
- Etc.

* Circles indicate social interaction between schools and parks.
Legend:

- local, commercial and light industry
- elementary schools...
- churches, local gov't
- high school and precinct government
- local parks and playgrounds
- cemetery
- row house units
- apartment house units
- mixed row and detached
- mixed detached and apartments
- mixed row and apartments
- detached units
- pedestrian grade separation
2. STUDIES OF AREA FOR DETACHED STANDARDIZED UNITS

The area pointed out in scheme four of the residential precinct studies has been selected for detailed study. The precinct studies indicate that the size of the area should be approximately 1200' by 1200' to satisfy the criteria of walking distances to schools and parks, etc.

It has become apparent that the standardized single family housing unit in its various forms -- the prefabricated house, the commercial builders unit, etc. -- will play a role of increasing importance in future housing schemes. It also presents challenging visual problems in large subdivision developments which must be dealt with if the new residential areas of our cities are to become a visual asset instead of an aesthetic detriment. For these reasons the area for detailed study will be considered in terms of analysing the visual problems of a subdivision for standardized units which would have a practical application for the commercial or speculative builder. This necessitates a study of vehicular access patterns to such units on flat terrain, (most builders seek out level sites for their developments) an analysis of the desirable characteristics of the detached unit for this type of use, and a study of lot subdivision and unit sitting with respect to the total space composition which these units and other space defining elements express.
Vehicular Access Studies:

The following schemes for vehicular access to detached housing units were considered. They are included to show what patterns or systems are held to express a logical organization of streets and street spaces when dealing with sites which are level. Most of the schemes it is felt have considerable merit with respect to various points of consideration. Many might be applicable in different blocks of the precinct depending on the particular circumstances and the varying requirements indicated by factors of block size, positional relationships with respect to school, park, and, adjacent residential areas, and the type of housing units which are to be constructed on the block. Therefore no one pattern need be, nor should be used exclusively in all blocks of the residential precinct. The circulation pattern for each block should be determined by the individual requirements of each block. To recognize this fact means that a natural variety of circulation systems and street spaces will be manifested within the various blocks of the residential precinct.

The scheme which is used for study in three dimensional form was selected for its inherent properties of economy, and to demonstrate as forcefully as possible that a simple orderly and direct circulation system need not be visually barren.

Basic Criterion:

Provide economical and direct routes of access for services and vehicular access to units.
Design Criteria:

1. Impede fast and non-essential vehicular traffic in interest of pedestrian safety, without resorting to an aimlessly meandering pattern.

2. Anticipate and consider the effect of circulation pattern on resulting street spaces.
The Results of an Analysis of the Standardized Detached Housing Unit:

The results of an analysis of existing prototypes of standardized houses which are in use by commercial builders and those which were proposed by the contestants in the recent competition sponsored jointly by the National Association of Home Builders and The Magazine of Building would indicate that certain types excel when it comes to dealing with their visual potential in large, subdivisions. Several possible methods of achieving variety were discussed in Part I. The most important of these is varying the different ways in which the unit can be sited with relationship to the lot and the garage. This factor is considered primary because it provides a sculptural medium for defining different qualities and quantities of residential spaces. The varied siting and orientation of the houses on lots however, need not be an arbitrary thing in terms of space sculpture. It has a deeper significance. Different prospective buyers have individual prejudices and desires when it comes to exposure for different rooms, location and size of fenestration, type and placement of auto shelter, size of lot, degree of outdoor privacy, etc. A subdivision which would satisfy these various desires of the prospective buyer would have a much better market potential than a development without this variety. This is a factor to consider in addition to its increased visual quality.

There are several characteristics which must be present to a high degree in a builders house which is designed for variety in siting on a lot. It must have as many exposures for each room as possible so that siting it in a particular way will not jeopardize a southern exposure or good circulation of air in important rooms or areas. There
must be a high degree of flexibility in fenestration treatment which can be used in each siting situation if a general good quality of the whole arrangement is to be maintained. It is illogical to treat houses which are oriented in different ways on lots with identical fenestration. Here is a potential variety which has not been exploited in the builders house and which could well prove to be very valuable visually as well as being practical from an economic point of view if a system of standardized interchangeable fenestration units is developed for a particular house.

Another characteristic that must exist to a high degree is a number of equally good locations for garage and service yard with relation to the basic unit. The foregoing characteristics would indicate that, in general, a builders house must have a high degree of many flexibilities in siting arrangement.

The house designed by Ralph Rapson, which won second prize in the N.A.H.B. competition was found to possess these three characteristics to the highest degree. This unit, with some variations in fenestration and other details, has been adopted for use in developing the area for detailed study. In addition to possessing considerable flexibility it offers extraordinary space arrangement amenities within the unit, a good economic potential, and a general excellence of design.

The Rapson House is a three bedroom unit. A two bedroom unit has been designed on the same basic scheme using the same utility core, etc. to satisfy the requirements of a home buyer who desires a two bedroom unit.

3 BEDROOM UNIT 1060 sq. ft.

2 BEDROOM UNIT 860 sq. ft.

Scale 1/8" = 1'
Interchangeable Standardized Fenestration Units
10' or 12'  10' or 12'  10' or 12'  10' or 12'

Glazing available in varying degrees of transparency

Carport

Group 1
Studies of Lot Planning and Siting Varieties:

The studies which follow show some of the possible variations in siting the detached units which have been selected for use. A prospective buyer would have a considerable range of choice to select from depending on his individual requirements and wants.

The size of lot is determined by the type of unit to be placed on it, the consideration of density, factors of economy and by frankly recognizing the fact that lot size requirements for different prospective buyers will vary with their affinity for gardening and yard maintenance. It is because of the latter reason that some lots are smaller in area than others irrespective of the number of bedrooms or the size of the unit. A consideration of all of the above factors has led to selecting lots of a uniform width of 60', but which vary in depth. A gross density figure of 4 to 5 families/acre for the entire area has been established as normal for detached housing and economically feasible for a commercial builder's subdivisions.

For the sake of contrast between various street spaces it was found that existing stringent setback requirements should be modified. A cartway width of 26' and a right of way width of 38' have been established for local access streets. The locating of garages on the right of way line would be allowed if one space for parking, which is not on the cartway, is provided for each unit. A garage or carport whose access drive-way is perpendicular to the street would require a setback of 20 feet from the nearest cartway line. In the case of a garage whose access drive is parallel with the street, the garage can be built immediately adjacent to the right-of-way line.
In dealing with the siting and design of a large area under singular control such as is possible here, it is important to realize that a good deal of space can be saved by careful study in the way individual structures are placed with respect one another. This however, necessitates a careful analysis of fenestration and landscape treatment of individual structures to guarantee against an invasion of the individual units' rights to light, air and privacy. Such savings and compatibilities are not possible where individual units are planned and built at different times by different designers and builders. If all residential structures were designed and built in total by one responsible agency, front, back and side yard requirements would no longer be necessary. They would as a matter of fact be a detriment because they would only obstruct many desirable solutions. It is recognized that such a liberal zoning regulation would not be practical as conditions exist today but for the sake of this design just such a practice is assumed.

It is recognized that where lot lines are established and the individual home owner also owns and controls a distinct piece of land, there is a natural tendency for these imaginary lot lines to become delineated physically. This means that the pattern of lot subdivision has a considerable visual impact on the residential spacescape. Rather than attempting to propose a radical solution which would eliminate some of the visual austerity which exists because of this tendency. An effort is made to organize a pattern of lot lines which will have a spatial impact.
Design Assumptions:

1. There is a natural desire in this country in particular to own a detached house on an individually owned piece of land.

2. Each unit should be provided with a feasible and workable site on its lot for a garage or carport whether it be executed initially or not.
3. THREE DIMENSIONAL STUDIES OF VISUAL CONSIDERATIONS

The following photographs of studies in model form are intended to demonstrate how fundamental visual principles which have been previously discussed, can be integrated with practical contingencies to form a satisfactory synthesis of all factors considered.
Although the area of the visual considerations of town design is so infinitely broad that many of its facets could not be considered, a rather extensive bibliography is included here. It represents the writings that have been perused but not necessarily studied in detail. Many of the items are included as an aid to those who wish to study some particular aspect in more detail. The Architectural Review was found to be the most comprehensive source of material.

Much can be gained that has been left out here because of a lack of time by perusing the issues of this periodical from 1930 to the present.

"A Scheme for the Center of Birmingham". Arch. Review, February 1951, pp. 91-97. Excellent verbal and pictorial analysis of town-scape principles applied to a proposed solution for Birmingham.


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BRETT, LIONEL. "Post-war Flats in Britain". Arch. Review, November 1949, pp. 315-322. On a mixture of building types for visual interest. Also deals with the pattern of layout—the grid.


"Legs and Wheels". Arch. Review, August, 1948, pp. 77-80. Deals with the color pattern and texture of floorscape as visual traffic regulators.


"Hazards". Arch. Review, March 1948, pp. 99-105. Very interesting attempt to deal with the visual and psychological effects of fences and barriers in the townscape.


EDWARDS, TRYSTAN. *Good and Bad Manners in Architecture*. London: 1924. Chapters 3 & 4. Discusses the "good mannered street" as a
unified whole. Excellent analytical treatment of the monotonous elements in streets. Sketches. Also discusses the problem of individual expression in domestic structures. Can be found in Widener Library at Harvard.


FEISS, CARL. "Housing and the Urban Aesthetic". Magazine of Art, November 1944, p. 258.


GIDEON, SIGFRIED. "Aesthetic Value". Arch. Record, June 1947, pp. 84-87.

GOLDFINGER, ERNO. "The Elements of Enclosed Space". Arch. Review, January 1942, pp. 5-8. Treats the actual elements with which the various effects of enclosure are contrived, and shows how they can be classified according to emotional effect.

"Urbanism and Spatial Order". Arch. Review, December 1941, pp. 163-166. The second of a series of three articles, each very fundamental, which analyzes the sensation of space in relation to the town.

Deals with the role of "weight" and psychology in fences.


"Time, Trees, and Architecture". Arch. Review, August 1943, pp. 52-53. Deals with the visual aspects of integrating trees with buildings for their mutual enhancement.


of composition.


MOORE, ROBERT. "The Outdoor Room". Arch. Review, January 1951, p. 51. Deals with elements of enclosure not ordinarily thought of in defining an "outdoor room".


PEVSNER, NIKOLAUS. "The Genesis of the Picturesque". Arch. Review, November 1944, pp. 139-146.

PIPER, JOHN. "Colour in Building, Some Old Friends". Arch. Review, November 1943, pp. 139-141.


"Colour in the Picturesque Village". Arch. Review, May 1945, pp. 149-150. Discusses three principle ways in which colour is used in space composition of villages. Very fine analysis.


Suggests how the visual charms of decay could be incorporated in the aesthetic repertoire of the modern planner.


ROBINSON, CHARLES M. Modern Civic Art. New York: Putnam, 1903.


SERT, JOSE LUIS. Can Our Cities Survive. Cambridge: Harvard University Press, 1942. Part IV. Deals with Sites, densities, neighborhood units, and space-height requirements. Also discusses the existing gridiron.


primarily with the grand street and visual qualities of squares and open spaces.

UNWIN, RAYMOND. *Town Planning in Practice*. London: Ernest Benn Limited, 1932. Chapters 1, 3, 6, 7, 8, 9, and 10. Largely concerned with visual aspects of formal and informal beauty, spacing and placing of buildings, roads, and streets, and the variety and harmony of the whole. Many illustrations.


