CHAPTER 14

VISUAL-AESTHETIC COMPONENTS IN THE CYBERNETICS OF URBAN PLANNING

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Portions of this chapter previously appeared in the following articles:
INTRODUCTION

The research work summarized here has been conducted at the Cathedral for Urban Planning at the Faculty for Architecture, Engineering, and Geodesy of the University of Ljubljana, Slovenia, in Yugoslavia from 1972 to 1978. The theoretical and methodological foundations were tested successively in the area of Kozarje near Ljubljana, and the research was extended to cover the whole metropolitan region of Ljubljana as part of the Year 2000 Master Plan worked out for the City Council of Ljubljana. One of the basic goals of this research was to find a scientific method of managing the visual environment which would enable society to control, simulate, and decide on changes in its aesthetic qualities. It is therefore necessary to encompass the visual message in some operational system, where it is quantifiable.

At this stage, it must be pointed out that the researcher's goal was not to develop mathematical aesthetics—beauty from a black box—but to rationalize visual-aesthetic relations in space, to determine objective conditions and solution spaces within which architectural creation could be realized. A flow diagram of the rational process used here is shown in Figure 14.1. A classical heuristic and intuitive approach in design problem solving can be qualitatively higher than the methodology shown here. However, rapid urbanization, personal mobility, behavioral changes, and the involvement of numerous designers all make control of the overall design of cities and regions increasingly difficult. The overall impact and interactive nature of visual phenomena seem to be impossible to govern without an objective, quantifiable model. The author has attempted to establish some objective limits to possible changes so that the basic visual-aesthetic qualities should not be lost but maintained.

HISTORICAL BACKGROUND, GOALS, AND ISSUES

Large-scale landscape design, as a part of urban and regional planning, began before the First World War with the introduction of garden architecture and theories of new cities. The period between the two wars saw the development of new theoretical work in the fields of visual aesthetics, perceptional psychology, and sociology. After the Second World War, ecology, system theory, integrated surveying, city and regional planning, and environmental sciences were included. With the work of Kevin Lynch (1960), the broader professional public became aware of and further developed the methodology of planning and visual environment. The approach outlined in this chapter is partly based on achievements of Appleby et al. (1964), Steinitz (1970), Eckbo (1969), Andersson (1973), and others.

Changes and interactive visual relations in space, properly organized into an information system, should be included in a city or regional data bank and thus become integrated into the system of comprehensive planning. With such a system, the overall outlook, control, guidance, and planning of the visual environment is possible. The design team in the analysis and evaluation of the visual message can include public opinion, provide a simulation of possible changes, and so forth and thus, to a large extent, objectively optimize visual relations in space.

INFORMATION SOURCES

From the numerous feasible techniques for recording the visual message, black-and-white panoramic photography in a horizontal plane was chosen to represent views. It is thus possible to simulate the visual experience of pedestrians, vehicle users, and so forth. Ideally, we should be able to take photographs from any point in space and at any elevation angle. Costs, time, and operational constraints, however, limit the possibilities to selected photographic viewpoints that generalize visual characteristics for the given planning scale. Visual inventory should be compatible with the spatial information system. In Yugoslavia, an orthogonal geodetical network has been accepted as a basis for data collection for different city and regional planning projects. Therefore its grid points are taken as the reference for visual inventory. At the urban planning scale, use is made of a 500 x 500 m grid; for a regional planning scale, a 1000 x 1000 m grid is used; 2000 x 2000 m is used for a macroregional scale, and so forth. Subdivision of the visual information network to architectural scale is also possible.

The visual information collected from one set of photographs should generalize the visual-aesthetic message within the grid cell from which

\[\text{Known as Gauß-Krüger network.}\]
FIGURE 14.1. Generalized information flow in testing the locational preferences according to the visual-aesthetic optimization.

FIGURE 14.2. An example of the use of a visual data bank: portion of computer printout of decoded visual information scene from a selected viewing point towards a chosen area (square).
centroïd the photographs were taken. It is thus necessary to extract from the photograph that information which is relevant to the planning scale, the defined goals, and the development tasks (Figure 14.2).

DESCRIPTION OF COLLECTED INFORMATION

What visual-aesthetic data should be collected? The basic pair of data is the coordinates of the photographic viewpoint and the centroïd of the observed grid cell. We must know the location of the observation and what we observe. The computer data bank contains all possible pairs of coordinates of observation points and observed points. This reserved space in the data bank either contains information (when visual interaction exists) or not (when the observed point is hidden from the observer).

The first piece of visual information relevant to each view is called visual topology: it is factual, “quantifiable” information, stating whether the visual message means direct, real visibility of the space (in the grid square), or only scenery beyond the space (that is, the visible scene is behind the square, which is not itself visible). The first case is called direct visibility, the second indirect visibility. The third possibility, of course, is invisibility (that is, from the observation point neither the square nor anything beyond is seen).

The second piece of information concerning visual interaction gives the aesthetic, compositional distance of the observed scene—whether it lies in near, middle, or far distance. Such an evaluation of scenery is based on perceptive, semantic, compositional, and design components. This visual-aesthetic distance is generalized into three main categories—near, middle, and far distance or screen.

The third piece of information is essential as it describes the visual-aesthetic substance, that is, the meaning of the scene observed. With this information, the panoramic view is divided into meaningful visual entities or segments. This subdivision is also followed by detection and coding of visual topology and distance. This information contains basic aesthetic signals such as points, nodes, edges, paths, surfaces, and so forth, together with semantic, compositional, and planning interpretations. The coded information included: (1) Ambient (self-contained, readable, beautiful images); (2) specific natural scenes (mountains, vegetation groups, streams, and so forth, recognized as visual entities or parts of the overall view); (3) specific man-made scenes (settlements, streets, squares, architectural monuments, and so forth); (4) other specific meaningful scenes (historical sites, ethnographic, technological, and so forth). This information was interpreted into five planning categories.

The first category should be preserved accurately, while those in the second category could be subject to small changes in the overall scene of which they form part. The third category of coded topology includes natural or man-made environments without specific visual-aesthetic meaning (built-up areas, fields, forests, and so forth), and linear spaces (roads, valleys, coasts, and so forth). These scenes could all be subject to conditional changes. The fourth category includes the continuous, monotonous parts of the picture, that is, connection between its parts (suburban urbanization, poor vegetation, monocultures, flat land, continuous hills, and so forth). For this category, certain changes in the existing scene are requested. The fifth category includes the most unpleasant and uneasy visual entities (eroded, polluted land; poorly maintained, old, and abandoned structures, and so forth) that must be changed or hidden.

With the information described above, the basic visual inventory is covered together with the viewing position to be discussed later. For development and planning, this factual information is supplemented by evaluative information of natural–man-made relationships in the coded scene, or, in other words, information concerning the extent to which the area is built up visually. Finally, a category of summarized visual-aesthetic quality is added to the coded scene, based on previous information, together with the accepted value system goals and planning tasks. This is classified from highest to poorest quality.

For practical application and physical development purposes, the information system was broadened into the field of decision making. For any specific coded scene, a value was assigned, describing to what extent the existing situation could be changed (from absolute preservation to complete change) and in what way (by the introduction of man-made structures, plants and trees, demolition, and so forth). For this decision-mak-
ing information, we must, of course, assume a certain planning requirement.

The last two pieces of required information try to measure viewing heights. They indicate from what height the coded scene is viewed, measured from the observation point, and also the height up to which one may change (that is, build, plant, destroy, preserve, and so forth) the existing visual environment, according to all the previously described planning issues. The heights have been generalized into groups for planning purposes—up to 2 m, up to 7 m, up to 18 m, up to 50 m, and over 50 m.

As can be seen, the basic visual information is quantitative. From this information is derived evaluative data and finally decision information. Thus it is possible to include in the process of visual identification, evaluation, decision making, teamwork, public opinion, and so forth. The visual information system can be broadened even further.

A certain area must be visually inventoried with panoramic photographs both inside the area and outside to the edges of visibility. Separate visual analysis of this type is reasonable in homogeneous, visually enclosed, and self-contained areas; otherwise, overall visual data banks are recommended.

**SOME TECHNICAL ASPECTS OF THE VISUAL INFORMATION SYSTEM**

This section describes some technical details of visual information systems which underlie the aforementioned theoretical work, as well as data processing.

Medium- or large-size computers are needed for the design, operation, and maintenance of such visual data banks which were researched in the late 1970s. The author used a CDC Cyber 72 computer and 1200 user active terminal on the batch basis. Fortran IV language was used for programming and is most suitable for spatial tasks.

The basis of the visual information system is two information types: one describing the "location" of the view, that is, the coordinates of the space observed (x, y, z), and the second describing the coordinates of the observing point (w, x, z). After fixing a particular view in the form of reserved space in computer memory, one can describe the particular visual message in a coded form. For instance, the coding x, y, w, z, T, L, N, 0, 3, 2, 1 means that the location x, y has been seen from the observing point w, z, as the direct view (T), to the near scenery (L), to the natural landscape (N), without man-made structures (0), with relatively good aesthetic characteristics (3), where few new buildings could be built (2); the height of visible structures is more than 7 meters (1), and new buildings should not exceed this height (1).

Our second important organizing point lies in the priorities of the information. Those data are first stored that are numeric and more constant; then they form the framework of the informative system. These are the coordinates of the observed space and viewing points, as already explained, the topography of the views, direct or indirect visibility of a certain space, and, finally, the visual height/elevation angle of the view expressed as a height of the visibility on the site:

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
<th>z</th>
<th>T</th>
<th>1</th>
</tr>
</thead>
</table>

Next, partly factual and partly subjective information is stored. This information is obtained either through photo interpretation or through value interpretations via public questionnaires: and includes distance of the scenery observed, density of buildings, visual quality, and so on:

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
<th>w</th>
<th>z</th>
<th>T</th>
<th>N</th>
<th>0</th>
<th>1</th>
</tr>
</thead>
</table>

Finally, information that pertains to decision making is stored—information which is changeable and includes planning decisions, such as possibilities for building, future densities, possible heights of new structures, and so on—all relevant for the particular view, of course:

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
<th>w</th>
<th>z</th>
<th>T</th>
<th>N</th>
<th>0</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>1</th>
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If necessary, more information could be added to the particular view.

Simple mathematical operations for visual analysis have been used. Primarily these have been average or mean values of the information within one space, assuming equal importance of all planning areas. Frequency of the views has shown us the visual sensitivity. Extreme values
of certain information have indicated limiting factors that could not be included into the computing of mean values. Finally, ponderation factors, obtained through public opinion, affected results too. These items can be stated in mathematical form:

\[\begin{align*}
i &= n \\
\Sigma i_{xy} &= I \\
I_{xy} &= \frac{i}{n}, F_i
\end{align*}\]

if \(n > a\) then \(I = I \cdot F_i\)  
if \(n < b\) then \(I = I\)  
if \(n\) then \(I = I \cdot F_i\)

if \(I\) includes any value \(U\) then \(I = V_i\) where

\[\begin{align*}
I &= \text{value of the information} \\
x,y &= \text{location of the information} \\
w,z &= \text{source of the information} \\
n &= \text{number of the information sources} \\
F &= \text{ponderation factor} \\
a,b &= \text{delimitations of visual frequency} \\
U &= \text{extreme} \\
V_i &= \text{assigned value of the information because of the extreme value}
\end{align*}\]

All basic information is scored in five levels such as highest, high, medium, low, lowest—quality, density, preference, and so forth. Such a polarization, which has been used by sociologists and gives relatively good and objective possibilities for further consideration, selection, or elimination of information. For instance, if the visual quality is being described from 1 to 5, from “ugliest” to the most “beautiful,” we can, through public judgment, assign them new values—keeping the best view, eliminating the worst one, and taking into account medium values with different ponderations:

\[\begin{align*}
\text{if } I = 5 & \quad \text{then } F = 1000 \\
\text{if } I = 4 & \quad \text{then } F = 2 \\
\text{if } I = 3 & \quad \text{then } F = 1 \\
\text{if } I = 2 & \quad \text{then } F = 0.5 \\
\text{if } I = 1 & \quad \text{then } F = 0.001
\end{align*}\]

\(I_s\) = new value of information \(I\) after the ponderation

**ROLE OF THE COMPUTER**

Information thus gathered from panoramic photographs should first be related to the site through orientation and photo interpretation. This information is written into relevant grid cells and from there onto the code sheets (Figure 14.3). In the data bank, pairs of coordinates for each “view” are stored first, followed by other information describing details of the “view.” Basic programs for handling the data bank include programs for storage and retrieval and simple listing of information in decoded form. Relatively large computer storage requirements are necessary.

More problem-oriented programs were developed giving certain analytical results. With the aid of the computer, it is possible to select certain relevant information (“views”), and summary information output (average values, and so forth) from these relatively simple programs can also be shown in graphic form using a digital plotter. Using differently shaded areas, the intensity of phenomena and suitability for various planning purposes can be illustrated (Figure 14.4). Drawn links between viewed and viewing points give graphs of directions of views (Figure 14.5). These graphs have been superimposed onto and reduced into grid cells to give the overall picture of visual relations.

More complicated programs have been developed for different tasks. Search routines can locate the relevant information in the data bank for any chosen spatial problem. This information is optimized with the use of median values, taking into account information frequency and extreme values. Different logical and do-statements were used. Completely automated interaction with a visual terminal has not been reached at this point. Interactive work is limited to automatic printout of values related to the panoramic photography, showing median information for each selected grid cell or “segment of view.”

**GENERAL USE OF VISUAL INFORMATION SYSTEM**

There are many uses for such a visual information system. Sets of photographic material can be used for different simulations of possible or planned changes. From the generalized and coded information on all visual relations in space, it is possible to optimize future land use in visual terms; aesthetic images of the space can thus be incorporated into a system of comprehensive planning. Each “view” gives its own solution space with determined horizontal boundaries, heights, and degree and nature of possible changes in the vis-
FIGURE 14.3. Example of information map: information from the photographs are transferred into relevant grid cells and from there via code sheets into the computer.
Visual-aesthetic components in the cybernetics of urban planning

Values. These outputs are reported separately, enabling “hand” control and decision making. Graphical outputs can also be provided for synthetic maps of frequency distribution of information, simulations of visual quality, possibilities of change, possible heights of obstacles, and so forth. With the final synthesis of these thematic maps with “hand” optimization, we achieve the final result—a proposition for future land use in visual-aesthetic terms.

Especially interesting is the graphic presentation of the so-called “visual situation” on a map of the site that has been covered with the information grid. Projected into each grid cell is its visual relationship to the surrounding site, that is, to all viewing points, thus showing the visible scene for each grid cell. With these visual diagrams projected into each grid cell, it is possible from observing all of them to detect the main directions of view and all other visual phenomena such as points, nodes, edges, paths, and surfaces.

**FIGURE 14.4.** An example of geographical output showing aggregate values of information in site. The degree of possible change in the environment is shown here.

The results of the visual analysis can be obtained from the data bank in alphanumerics or in the form of decoded listings of information. Information from certain viewpoints, or the ones contained in certain grid cells, or combinations of both, can be called. Furthermore, it is possible to ask for only certain information or values, by introducing limits, constraints, and conditions, and thus come close to a particular planning task. Computer programs have been developed for the optimization of an average value of visual information in a grid cell, following qualitatively higher information and taking account of extreme

**PRACTICAL TESTING OF VISUAL MODEL: FUTURE LAND USE OPTIMIZATION**

All the theoretical approaches described above have been developed as part of a proposed methodology for visual optimization of the location of housing, industrial buildings, services, recreational areas, infrastructural corridors, protection and preservation areas, and so forth.

The hypothesis and theories have been tested on a site at Kozarce, near Ljubljana, Yugoslavia. As the scale of the problem was one of master planning, a grid 500 x 500 m was used. The test site was inventoried through 60 viewing points on 1000 x 1000 m grid. Photographs were taken inside the test site, at its limits, and outside to the limits of visibility. Panoramic photographs were laid out in a circular way, inventoried, evaluated, and coded (see Figure 14.6). Information maps were created following the orientation (that is, transfer of coded segments onto topographic maps and thus into grid cells), and through photo interpretation, that is, recognized geomorphology, vegetation, land use, and so forth.

The goal was to optimize future urban development of the site in visual terms, assuming equal importance throughout the test area and of all observation areas inside the test site and outside it. Thus the average values of data in each grid cell
FIGURE 14.5. Computer-produced graph of visual relations in the site: map showing locations and sources of information within the site giving directions of views.
FIGURE 14.6. One of the 60 panoramic photographs used in this test. The map shows visible area—both direct and indirect—from this point.

were obtained. In the case of equal or dubious results, higher values were followed in order to preserve as many of the existing values as possible. Various decoded printouts of average values, frequency, extremes, and so forth were used. Graphical outputs of visual exposition (frequency), direction and topology of views (visual situations), possible degree, nature and height of changes in existing image, and so forth were required. After synthesizing these thematic maps and by manual interpretation, final results in the form of a land use map were produced. In this final step, of course, it was necessary to disaggregate the result from grid cells into real space again.

HIGHWAY TEST

The second important test on the same site was more application and problem-oriented by nature. The problem was to evaluate the future urban development on the site, following the proposed highway through this area. It was necessary then to optimize future developments from the visual-aesthetic point of view, with respect to the views from the highway (car driver's experience) and from the area to the highway (the experiences of residents, workers, and tourists). The solution was then obtained through optimization of average information, relevant to the grid cells in which the highway was located. The position of the
USE OF THE VISUAL MODEL IN THE MASTER PLAN OF LJUBLJANA

These first methodological approaches have been applied in the larger practical problem—in the future urban development of the city of Ljubljana as the part of the new Master Plan (Figure 14.8). All urban areas have been covered with 1km x 1km grid and inventoried with 60 observing points. A visual inventory and general public opinion results about the visual environment have been incorporated into the master planning process, for example, possible development and protection areas, possible changes in visual structure, building densities, heights, green screens, and so forth.

Within the third research stage summarized here, previous findings were made applicable to real planning situations. General goal formulation of this research could be defined as allocation criteria of different land uses, according to visual aesthetics. Before progressing, another problem had to be resolved that has not been addressed enough in previous studies; that is, visual inventory, evaluation, and decision making should be based, to a large extent, on public preferences, attitudes, and traditional values.

Therefore a broad public questionnaire was administered to ask people’s opinions about typical vistas, scenes, and other environments; it was later incorporated within the research. These views—and the opinions about them—should represent all other similar visual environments. Results of the questionnaire were processed by computer and analyzed via correlations between social groups and their preferences, different types of scenes, people’s attitudes, and so forth. Photographic material was then inventoried and evaluated according to public preferences, and such data was stored in the computer.

Based on social research and photo documentation, further research can become much more objective. As already defined, the basic goal was to define location criteria for new land uses, to research visual absorption of the landscape and the dynamics of visual changes, and so forth. All these problems were approached through numerous tests.

Each test, as mentioned above, consisted of an
The initial hypothesis about the visual location criteria. Such criteria was based on overall visual performance criteria such as: town centers should be visually well exposed, industry should be hidden in unattractive areas, and so forth. These hypotheses were tested in real planning situations. The results of the test should have some overall meaning; its inputs should be generalized as well. Thus industry, for instance, has always been assumed to be visually unattractive, city centers are interesting landmarks, housing is aesthetically neutral built-up scenery, and so on. On the other hand, the test sites should generalize the outlook and planning conditions of a typical Slovenian landscape. Therefore, an area of cca 500 hectares near the city of Ljubljana was chosen that was rich and diverse in its natural and built-up qualities.

First, the test site was fully visually inventoried and evaluated, according to the methodology explained before. Social values were computer processed and analyzed, and various visual characteristics of the site were determined through graphic routines.

In the first step of each particular test, the lo-
cation of new land use, such as industry, housing, and so forth, was approximated into relevant grid cells. Summarized visual-aesthetic qualities of these grid cells were examined, yielding information about visual exposition, compositional qualities, scenic values, and so forth of that particular site. These synthesized data were presented in the form of various listings or computer graphs. This first part of the test already gave a certain feedback to the initial hypothesis. Much better results than those obtained through this automated technique have been obtained with visual simulations on the photographs. Proposed land use has been traced on the relevant part of panoramic photographs in the generalized form of a white strip (see Figure 14.9). Simultaneously, the computer-written information has been applied to the same segment of the photograph, giving aggregate information about that space. The result has been finally transformed in real space.

Different comparisons were made between the existing landscape and the one after new land development, or between successive developments. Comparisons were made with special attention to changes in visual message content and the data bank as a whole. After comparisons of visual simulation together with computer processing, the initial hypothesis was corrected, and new testings of different conditions were undertaken.

The author has described the general layout of the tests. The tests, however, have been interconnected, just as the visual relations in space are, in reality, influencing each other. All tests have been divided into three main "categories." First, different new and isolated land developments have been tested—housing, industry, urban centers, and so on. In the second group were the interactions between new land uses such as housing versus industry, recreation versus centers. Combinations also included three or more new developments up to the complete building development of the test site. The third "category" included tests that researched more delicate or "advanced" problems, like successive visual changes in the landscape—new developments occurring one after the other—visual absorption of natural landscape, congestion or "pollution" with various visual messages, and changes in "reading" the image.

**LOCATION CRITERIA ACCORDING TO VISUAL AESTHETICS**

First, the author examined housing development. The test indicated that housing—if assumed to look like monotonous structures without specific attractive characteristics—should be located in visually less exposed spaces, with relatively good views on green surroundings of city centers. New housing locations should tend to have a certain density and to connect scattered development, giving the observer clear interrelations and delimitations of natural landscape and built-up land. Low-density housing hidden in greenery should be favored where the green character of land should be retained for far views. Housing can be visually connected to recreational, tourism, or nature preservation areas. Proximity to traffic lines or industry should be avoided. Location close to energetic or long "strips" of continuous housing that cover between one-fourth and one-third or more of the 360° horizon should be interrupted with green sections. Orientation views on sur-
rounding landmarks or distant mountains should be provided.

Second, industrial land use has been tested. Industry, including services and other commercial developments, should be located in visually hidden spaces with poor or no specific aesthetic qualities. Views from such sites are not of particular importance except in terms of psychological needs for the views of greenery from the working spaces. Views of industry are most often visually unfavorable and should be hidden with greenery, put in valleys, or should be part of neutral, intermediate scenes. Heights of development should be limited in order to promote distant vistas. Location could be close to traffic or communal infrastructure. Proximity to city centers, housing, or recreational areas should be avoided or hidden behind green screens. Location near the areas of protection of nature or monuments should be excluded.

City centers—commercial, tourist, sport center, and so forth—are regarded as attractive landmarks or visual nodes. Therefore they should be located in visually well-exposed spaces—cross-sections of paths or edges, as a summit of visual experience, or as a contrast to existing values. Views from the centers should be good as well, especially to the main traffic corridors, dependent housing, main city image, and so forth. Location should be near traffic corridors, housing, recreational, or other green areas, but far from industry, services, or communal infrastructure.

Recreational land use, as well as the areas of nature- or monument-protection, should be located in visually attractive, well-exposed, and distinct sites. Views on the green recreational land use are preferable from all other land uses; views from the location, however, should be insured to the surrounding landmarks, centers, and main city panoramas, while views on the housing or traffic corridors are just conditionally permitted. Views to industry, energy, or communal infrastructure should be excluded.

Traffic networks, such as roads, railways, paths, and so forth, have their visual locational criteria, too. It is important that the views from the networks are broad and good, giving the observer the sense of orientation, showing landmarks, far-distance scenes, and so on. Views to these networks are usually not favorable, and planners usually want to hide them from recreational, housing, or central land use. Limits of visually enclosed, unique spaces often match these contradictive criteria. Therefore locations along the visual paths, edges, and neutral spaces between visual entities is desirable. Cutting across valuable visual environments is critical.

Power plants, city supply systems, “heavy” industry, pipelines, disposals, and so forth are usually visually most unfavorable and require hiding. Therefore visually unexposed spaces without existing qualities are needed. Views from such sites are not important. Lower elevation, surrounding greenery, or other screens should hide them. Close location to industrial sites only is possible; all others require large buffering greenbelts.

Besides these basic tests, the author has started research in other fields of visual analysis, too. One field has been testing the visual absorption of the landscape for man-made structures. Absorption, of course, is dependent on topography, vegetation density, existing buildings, and so forth. However, a certain psychological limit has been found beyond which a landscape cannot be perceived any more as green, rural scenery, but as an urbanized built-up area if more built structures are located within it. In slightly hilly landscapes partly covered with forests, this limit is up to one-fourth of the 360° panoramic scene covered with built structures of “dense type” such as highrises, factories, streets, and so forth, up to one-third if covered with “lower density” structures such as row housing with small gardens, pedestrian paths, sport facilities, and up to one-half if covered with the structures of the “lowest density” such as individual housing in greenery.

In this research, the author has also started to use computer graphic simulation of the landscape, which could lead to a quicker, more automated, and cheaper visual simulation. At this point in the research, experiments have started with the program “Oblix,” originally developed at the Center for Computer Graphics at Harvard University by Thomas Adrian (1972). It enabled axonometric or perspective pictures of a landscape to be generated, portrayed by a net layer over the topography and vertical cross-sections through the relief. The greatest advantage of this computer program is the one that enables drawings of the relief, stored in digital form.

One of the shortcomings of the research has certainly been that new buildings have always been generalized in the form of a white strip and their actual appearance has been neglected. Therefore the location criteria, cited above, should be regarded as only the most general
planning principles. Specific realizations can overcome these considerations: a nuclear powerplant, for instance, could have an appearance of an attractive sculpture in green open space, while the most modern commercial center could look very unattractive and visually "polluted." Further research should be undertaken in the field of visual perception and cognitive experience of the visual world. Visual absorption should be connected with the meaning of visual messages, and "visual" should be broadened with other information channels that give the observer the most general and overwhelming "gestalt" of the aesthetic.

On the other hand, however, research of this sort could lead us more and more astray to specific and endless psychological questions that are too far removed from actual planning. Therefore we are forced to certain limitations, generalizations, and operational results that will actually help planners in land use decision making. Computer graphics that will replace our photographic documentation could be a great help, and many more endeavors will be applied to this research field in the future (see Chapters 4 and 16).

The importance of public opinion to "weigh" the visual information was mentioned in the introduction. From the year 1975 on, the author felt more and more that research must enter deeper into the sociological and psychological essence of the visual message. Therefore research was conducted in this field and was linked with the photographic and computer techniques previously described. In the following section some recent approaches and findings in this direction are explained.

ENVIRONMENTAL PREFERENCES AS PART OF THE VISUAL MODEL

Research in the field of environmental preferences has recently been done by several institutions in Yugoslavia. Studies include the Demonstration Study of Ljubljana Region, sociopsychological research on the new housing development in Belgrade, central parts of Sarajevo, and green spaces and public parks in Ljubljana. These studies, however, have largely been based on an abstract written questionnaires with a corresponding sociological interpretation.

Encouraged by similar research in foreign countries, especially that in the United States (Appleyard and Fishman 1977), Great Britain (Southworth 1971), and Sweden (see Chapter 15), and based on some of our previous studies, the author has recently conducted a large research project based on the method of the photo-interview. The goal was to discern public opinion regarding the protection of nature, urbanization, demolition, recreation, and so forth as obtained by and expressed directly on photographs. The final aim of such research (financed by the Research Community of Slovenia) has been the detection of sites most attractive for private housing, recreation, and other land uses so that they may be protected or used appropriately. Furthermore, the researchers intend to test what part environmental "beauty" plays in relationship to other factors such as land cost, existing roads and communal ducts, public services, land ownership or urban documentation.

First, a sociological study incorporated a typical written questionnaire without the visual presentation of the phenomena. The test site was Ljubljana, city of approximately 300,000 inhabitants, and capital of Slovenia, Yugoslavia. The pilot sample of 180 citizens was representative in sex, age, education, distance from the city center, and housing types. The subjects were asked different questions regarding the city and its surroundings. Subjects expressed their opinions regarding housing preferences, aesthetics of the city image, most important vistas, most favorable leisure grounds, worst city scenes, and so forth. The results did not differ very much from the ones expressed in previous similar studies. Citizens ask for quiet, peaceful neighborhoods with greenery and less industry and traffic noise. On the other hand, they would like efficient traffic flow, jobs close to the home, new shopping centers, and so on. One can see that the answers are, to a large extent, contradictory and abstract. Absence of the visual (graphical) presentation media seems to be a serious shortcoming since people can imagine any urban environment in response to the question or answer. This problem could be avoided using photographs, that is, the method of photo-interview.

A pilot sample of 60 citizens of Ljubljana was chosen stochastically and was representative in terms of sex, age, education, housing structure, distance from the city center, and so forth. Each was asked six questions looking at six groups of six panoramic photographs—altogether 36 city vistas. (Thus altogether 216 panoramic black-and-
white photographs with the dimensions of 40 x 3 cm have been used). These panoramas displayed the typical “representative” scenes from Ljubljana and its near surroundings: the city, the suburbs, villages, green landscape, forests, and similar landscapes.

Each subject had to mark on each photograph at least one “place” that corresponded most to the question asked (marked with a circle), and at least one “place” that was the most unfavorable for the question (marked with a cross), or, in other words, the place that he or she “liked” and “disliked” the most. Where more sites than one were chosen, they all counted as one in the statistical overview. Subjects had to decide where they would build their own house, where they would protect nature, where to go for a walk, to play, to do sport activities, or where they would remove existing structures, and permit new urban development.

The sample was very small; a large convergence of the opinions, however, proved its representativeness. Some interesting results followed.

The most favorable sites chosen for land protection, recreation, and sports activities were open green spaces close to the city with various ambient qualities such as forest edges, hills, rivers or creeks, farmland, and so forth (93 percent). Practically the same percent (95 percent) would build their own private house in the same sites if they were in a position to do this. Although the open green space is very attractive for private housing, subjects (67 percent) would rather build their house in some connection with existing housing (close to or in between). Thirty-five percent would avoid building on empty, large, vacant, or remote spaces and out of the dense city fabric.

If subjects were in the position of “urban planners,” they (88 percent) would permit housing only as infill of the existing urbanized areas or, partly, as the enlargement of them. In this role, subjects became real “ecologists” and wanted to protect green spaces to the highest degree (74 percent).

Subjects responded to the landscape details and indicated that the most favorable landscape features for sports, recreation, and leisure uses were forest edges (74 percent) and, to some extent, flat green fields (23 percent). In terms of housing preferences, respondents would largely prefer to live in groups of individual houses in green suburbs (50 percent); some would have chosen green open land relatively far from the city (21 percent), and some even inside the existing villages (17 percent). On the other hand, they disliked living inside the city (57 percent) or even in suburbia (26 percent); and 9 percent chose modern and sophisticated highrise apartments as the worst place to live!

In further research, the author tested the degree to which the ambient preferences were due to existing housing location. At this point, one should take into consideration the locations of unapproved housing in Ljubljana region only. Thus 53 percent of it is located in natural landscapes, and 18 percent at the forest edge (within 100 m). More dominant roles are played by other factors such as accessibility (87 percent is within 10 minutes isochrone to the public transport and 53 percent is within five minutes) to bus lines or local streets (73.5 percent is located at the local road). Fifteen percent is inside the gas network and 8 percent is located inside the water heating system. Only 18 percent are on the actual sites declared as the ones for housing developments; 33.5 percent is close to the existing local service center. More than half of the housing units are grouped in clusters, and very few are completely isolated.

These results prove that ambient preferences actually play a more minor role than expressed in photo-interviews. Location in greenery and grouping clusters seem here to be the only two significant factors largely expressed. Financial, practical, and other reasons seem to play much larger roles, and the ambient preferences remain, to a large extent, “castles in Spain.”

The third research project attempted to test how the photo-interview can be used in practical decisions and planning proposals. The practical problem was chosen in the city of Piran on the Adriatic coast. This medieval, picturesque city, strictly historically preserved, has urgent traffic problems. A new ring road close to the city core was proposed. The road, as it would appear, was traced onto large photoposters from different viewpoints. A large sample of the citizens of Piran, tourists, experts, and Slovenes from other regions were asked for their opinions. People participated very actively; they would rather maintain a green belt around the city than have more efficient traffic. The method proved itself as a very powerful tool in planning decisions.
In the fourth research project, a final step was attempted regarding respondents' participation in the photo-interview. People actively participated in planning decisions: they traced onto the photos their proposals regarding new housing, roads, demolition, greenery, and so forth. Photographic copies were used as the material for the interview, or the transparent overlays were applied to the originals. Respondents were active in this interview, too (20–30 minutes for each person). However, large differences in the abilities of graphic expression seem to be a significant shortcoming of this method. The answers now were very direct and explicit, which was not the case with the questionnaires without the use of photographs. The mean and the most frequent answers were used to draw the plan of “people’s wishes” and demands for the better urban environment in the center of Ljubljana. This “plan” differed substantially from the official urban planning regulations regarding traffic, green spaces and parks, historic preservation, sites for reconstruction, and urban renewal. In spite of the operational results that were obtained through this method, this method of the “active participation” in the photo-interview must be regarded as a marginal approach and technique. Difficulties in the graphic expression and large cost and time demands join to limit its use in urban and regional planning.

In the fifth research project, the method chosen seems to be the most powerful, fast, and inexpensive for a large experiment in different Slovenian regions. The technique of the “passive photo-interview” was used. Thus public preferences were examined regarding housing, recreation, leisure, and so on, evaluation of scenic beauty, and proposals for better urban and rural environments. This research was conducted in 10 different Slovenian regions. In each of them, a pilot sample of 30 people was chosen stochastically, which altogether yielded 300 subjects. The technique of using the transparent overlays applied over the photographic posters was very successful. Black-and-white photographs were used, covering 90°–160° angles with the dimensions approximately 5-by-30 centimeters. Photographs illustrated the most representative vistas in the relevant region, showing urban, rural, and vacant (natural) environments. A comparison between the results in each region was made, showing substantial regional differences. These differences, however, could be due to the unequal photographic material. In general, Slovenian subjects expressed, through this research, a profound love for nature, forests, mountains, and rural landscape. They refuse to live in the dense city fabric, especially in highrise apartments. They prefer living in individual homes in the greenery nearby the cities. They dislike industry and traffic corridors and would not like to see them in the vicinity. Differences between the preferences regarding housing location and leisure grounds can clearly be seen (they prefer the same types of landscape if asked on two different photographs).

The author feels that the method of photo-interview could play a great role in advocative and societal planning. Through this method, public opinion is expressed directly in a way that is usable for urban and regional planning. The author hopes that this methodology will become a permanent approach and an integral part of our planning as one of its self-management components.

CONCLUSION

Similar tests have been made for visual evaluation of other proposed land uses in the site (for example, housing and industrial zones). The research was concluded with a consideration of how to establish visual data banks on different scale levels (for example, local, architectural, urban, regional, statewide). Timing, financial, and personal needs have been estimated and identified for possible future users.

The approach described in this chapter is basically an exploration of visual interaction, a possible means of quantification, compatibility with other data banks, and a systems approach to the problems of visual aesthetics. This methodology should lead to a new stage in development of more cultural, more humanistic, and less economical, technocratic approaches to urban development. Visual-aesthetic analysis should be applied in any ecological method, and we have tried to make it more easily measurable, operable, and understandable.

Future directions of this methodology are in the automation of the whole system: direct digitizing of the photographic material (computer perspective of the grid with coded cells laid over the photograph) and automation of the visual message (computer perspective with land use characteristics, taken from the data bank and
traced on it). Such future developments—which could never replace human judgment and the gestalt of the visual message—could lead to faster, cheaper, and easier-to-handle solutions. Of particular importance will be research into the following: visual dynamics, changes in visual environment, visual absorption of the landscape, and psychometry of different responses to visual messages.

The research is interdisciplinary by nature, which is both its strongest (because of new achievements) and weakest (because of the poor scientific basis for each field) feature. The methodology calls for continuous planning since the visual world is ever-changing; the visual data bank should be completed and reevaluated occasionally. We should be able to control these changes by introducing new qualities, but at the same time, retaining the specific, existing qualities.