WHY BUILDINGS ARE KNOWN

A Predictive Tool for Architects and Planners

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If we could predict how well buildings and structures in the city were known, planners and architects would be in possession of a powerful design tool, for we could begin to gain some control over that elusive communications medium, the urban environment. To do this, we have to go beyond Kevin Lynch's (1960) identification of known urban element types. We must determine the reasons why these elements are known which means discovering the attributes that capture attention and hold a place in the inhabitant's mental representation of his city. This is the subject of our investigation.

During the planning of Ciudad Guayana, the newly growing industrial city in Venezuela, over three hundred interviews were carried out among the existing population of about 30,000 people, related to their perceptions of the city. One of our particular concerns was to check whether the traditional graphic vocabularies of land use and site plans were relevant to the inhabitants' experience of the city. Did the population see the city in

terms of land uses, as physical forms and spaces, or did they see it as an economic or political structure? Did they picture the city as a social pattern, a kind of mental layout of the census data, or as a setting for personal activities and journeys, or was it to them a sensuous environment of sights and sounds, colors and textures? We limited our investigation to the ways in which our respondents identified and recalled individual buildings under various simulated conditions.

Description of Respondents

Groups of 75 persons were drawn from each of four residential areas of the city, a low density American-style suburban development (Puerto Ordaz), a densely settled squatter community (Castillito), a low-density planned self-help community (El Roble), and a higher density colonial-style small town (San Felix). In each area, a complete survey of households was carried out from which 75 units were randomly selected and a quota system was established to ensure sufficient numbers in each age, sex, and education cell. Other personal information gained from the respondents included their familiarity with the city, their physical mobility, and their travel mode. In addition, two groups of ten were drawn from residences of the company executives and the construction engineers to make a total sample of 320 persons. Twelve interviewers were trained by a sociologist to make the surveys and experienced little difficulty in having respondents take the general interview.

The total sample (table 1) contained a broad cross-section of the population. Respondents were distributed about evenly among those under twenty, those between twenty and thirty, and those over thirty. Approximately one-half had received only a partial or complete primary education. One-sixth had been in the city under one year, and over one-half had lived there for less than five years. Over one-half travelled dominantly by bus, and about one-quarter each travelled by car or *por puesto* (collective taxi). Two-thirds were male and one third female. Although only about one-half responded particularly to the map question, the cross-sectional proportions remained approximately similar to those of the general sample with slightly more losses from the aged, the uneducated, the unfamiliar, the female, and the bus traveler groups.

Method of Investigation

All buildings, establishments and other landmarks recalled by the inhabitants in response to three questions were recorded, photographed, and scaled for the presence of an array of attributes which the investigators hypothesized might be critical to their identification and recall. These

TABLE 1

RESPONDENTS

	Verbal and Trip Recall	Map Recall
Familiarity		
under 1 year	41	14
1 year to 5 years	129	63
over 5 years	144	72
Age		
under 20 years	99	56
21-30 years	75	35
over 30 years	140	58
Education		
some university	32	10
some secondary	83	56
some primary	167	77
none	32	6
Sex		
male	192	102
female	122	47
Travel mode		
bus dominant	167	73
collective taxi		
(por puesto)	64	35
auto-dominant	83	41
Spatial mobility		
within neighborhood	207	93
within half city	68	35
within whole city	39	21
Total	314[a]	149[a]

[a] Out of 320 respondents, usable answers for verbal and trip recall questions were obtained from 314 persons. Only 149 respondents of the total 320 were able to provide information to the map recall question.

attributes were selected after careful investigation of the frequencies achieved by different kinds of buildings, and after perusal of free verbal responses to questions asking subjects to describe certain buildings in the city. The scalings were then correlated with the frequencies of element recall in each of the three sets of responses in order to assess which attributes were capturing more attention. Stepwise regression analyses were also carried out to explore the predictive possibilities of the method.

The three questions (translated from the original Spanish) were:

Free verbal recall: Can you tell ... which points or places in the city and its environs you remember best? (122 elements mentioned)

Free map recall: Please draw a map indicating the points and places in the city which you have just mentioned. After that add any other important features that come to mind. (188 elements mentioned)

Free trip recall: Would you please describe the road which goes between the steel mill and San Felix mentioning the appearance, the changes in direction, the views, and all the important or interesting features of the city which you see on this trip? (104 elements mentioned)

Building Attributes

Our major assumptions were that an inhabitant would recall a building or place for some combination of four reasons: (1) the distinctiveness of its physical form, that is its "imageability" (Lynch, 1960); (2) its visibility to him as he travels around the city; (3) its role as a setting for personal activities, use and other behavior; and (4) the inferences he makes about its cultural significance to the population at large. (See tables 2, 2A,

TABLE 2

FORM INTENSITY SCALES (verbal rules)

	Low	Medium	High
Movement	No movement.	Potential movement, parked cars, few people.	Many people, moving cars, flags waving, water falling.
Contour	Slurred boundaries hidden by vegetation attached to other houses.	Semidetached corner buildings.	Isolated buildings with sharp contours.
Size	Single-storey buildings: houses.	Two-storey buildings: movie houses.	Over two-storey buildings: industrial sheds, steel mill, General Electric.
Shape	Simple.	Two or three block buildings.	Complex building divided into several parts.
Surface	Plain white.	Colored.	Brightly contrasted colors and textures.
Quality	Bahareque (wattle), mud floors outside, no fences.	Modest materials, walls, garden.	Landscaped, fenced, expensive materials, clean conditions.
Signs	No signs.	Small signs.	Large signs readable from a distance.

TABLE 2A

FORM INTENSITY SCALE (graphic rules)

	Low	Medium	High
MOVEMENT			
CONTOUR			
SIZE			
SHAPE			
SURFACE			
QUALITY			
SIGNS			

3, and 4.) When considering the recall of buildings by the population as a whole, we combined the last two sets into one measure of community significance.

The distinctive form of each facility was assessed usually from a viewpoint in front of its main entrance, or from its most common approach view. From this viewpoint any noticeable qualities which might make the building stand out were rated, both on the basis of their absolute intensity within the city and for their singularity in the local surroundings, the neighborhood, or the city as a whole. The two measurements were made because it appeared that the relative distinctness of a facility might be more important than any absolute characteristic.

The component attributes of buildings predicted as contributing to their imageability, were the intensity and singularity of their apparent movement, contour, size, shape, surface, quality, and signs. (See table 2, 2A.) The intensity of each attribute was an absolute measure of its presence although the scale was calibrated to fit Ciudad Guayana. Hence, three or more storey buildings were given high rating for size because they were among the largest buildings in the city, although in larger cities they would probably be given a low rating. The singularity of attributes was a relative dimension measured by the scale at which they were deemed singular. Attributes of a house that were singular only in the local context would receive a low score on the singularity scale. Attributes, like those of a primary school, that were singular in the neighborhood received a higher score, and those which were singular in the whole city, like those of the steel mill, received the highest singularity rating. Neither the intensity nor the singularity of any attributes alone were predicted as sufficient to capture the attention, for a singular building could be uniquely small, or a prominent sign could be lost in a sea of prominent signs. Both attributes were later found to have comparable influence over recall.

Unless a building is seen, it cannot project an image. Visibility is, therefore, a necessary component for recall. It is a measure dependent on the location of a facility—the visual counterpart of its accessibility—and on the focus of the city inhabitant's actions and vision. Many buildings which were both distinct in form and significant, like the INCE adult education school, were seldom mentioned because they were off the main routes through the city. Only those who used such a building might know of it—not a very successful public relations asset. The visibility of each building was measured by three component attributes: (1) its viewpoint intensity, an estimate of the numbers of people who might regularly see it from its most commonly used viewpoint; (2) its viewpoint significance, its presence at important decision points or points of transition on the city's circulation system; and (3) its immediacy, a measure of its distance and centrality in the line of view (see table 3).

TABLE 3

VISIBILITY SCALES

	Low	Medium	High
Viewpoint Intensity	Visible from tertiary roads.	Visible from main roads outside urban area, secondary roads in city.	Visible from main east-west road, Puerto Ordaz to San Felix, main pedestrian centers.
Viewpoint Significance	Visible at points of no transition or at decision points on tertiary roads.	Visible at secondary decision points, bends, etc., on major roads, or major decision points on secondary roads.	Visible at major decision points, intersections, bus stops, ferry landings on major roads.
Immediacy	Distant objects, poorly seen on main roads, or near objects off axis on secondary and tertiary roads.	Near objects off axis, distant objects on axis on major roads, or axial objects on secondary roads.	Near objects on axis, cutting across line of vision on major roads.

TABLE 4

SIGNIFICANCE SCALES

	Low	Medium	High
Use Intensity	E.g., bars, abastos, primary schools.	E.g., small supermarkets, small hotels, clinics.	E.g., commercial zones, warehouses, churches, schools, hospitals, bus terminals, etc., banks, steel mill.
Use Singularity	Local singularity, e.g., bar, repair shop.	Community singularity, e.g., primary school, dock, bus terminal.	City singularity, e.g., police station, hospital, C.V.G. office building, cemetery, radio stations.
SYMBOLISM cultural, economic, aesthetic or historical, (in addition to use intensity or singularity).	High use and high or low symbolism, e.g., schools, churches, office buildings.	Medium use and high symbolism, e.g., factories, police stations.	Low use and high symbolism, or high use and very high symbolism, e.g., hydroelectric dam, radio station, statues, steel mill.

The measure of viewpoint significance was introduced when it was found that many physically and functionally insignificant buildings at major decision points, at bus terminals, and at the entrances to settlements were frequently recalled. This could be attributed either to the high attention levels of travellers at these points or to their need for identifying these points with associated buildings for purposes of social communication or personal recall, since few of the intersections possessed their own names.

It should be noted that both viewpoint significance and immediacy were composite scales which included viewpoint intensity, so that a decision point or a location of high immediacy on a minor road would be rated lower on these scales than one on a major road.

Finally, the community significance of each facility was assessed by use intensity; by its use singularity, a scale performing a similar role to that of physical singularity; and by its social, political, economic, aesthetic or historic symbolism (see table 4).

The use intensity and use singularity measures were relatively objective and easy to make. The measure of singularity was made in an effort to account for those facilities that had a wide realm of users. When functions were highly singular but catered to a narrow realm of users, the ratings of this facility type were adjusted downward accordingly.

The most elusive measure was that of symbolism. Use intensity and singularity could not account for well-known facilities that were not used intensively, like historical monuments or the hydroelectric power plant. An assessment of symbolism was therefore made for every building after consultation with two professionals who had lived in or had contact with the city for three years. The scaling of symbolism was only applied to symbolic facilities which were not already accorded a high use intensity rating. Hence, a school, although of symbolic importance to the community would not receive a high score on symbolism because it had been accounted for as a building of high use intensity. The hydroelectric plant which was relatively unused did receive a high score on the symbolism scale.

The scalings passed through three or four iterations, during which the characteristics of all buildings mentioned by the inhabitants were inspected, usually on photographs, and salient attributes were hypothesized. Each building was scaled, regressions were run, and the scaling rules were modified. The final set of attributes to be correlated still included some which achieved very low correlations. The categorizing system faced the usual difficulties of deciding how far to disaggregate. Disaggregation allows for simpler scaling measurements, but gives lower individual correlations and makes reaggregation difficult. The case of viewpoint significance was a typical example. Had the scale been completely independent, all decision

points, even on minor roads, would have been accorded a high score, and consequently, correlations would have been very low. Since the scale was combined with viewpoint intensity to give higher scores for decision points on major roads, it received higher correlations, but was now a composite attribute.

The final coding rules for the scales are shown in tables 2, 3, and 4. The scalings were carried out by two raters independently. They were found to be in general concurrence, but where differences occurred, they were resolved by joint agreement.

Intercorrelations Between Attributes

The attributes of form, visibility, and significance were seldom equally present in any one building. (See table 5.) When the array of buildings mentioned on the maps (188) were rated and their component attributes intercorrelated, there were some high intercorrelations within the major attributes. For instance, the singularity and intensity of form attributes were moderately intercorrelated (usually about r = .50) suggesting that it may have been unnecessary to distinguish them. The size intensity or singularity of buildings also correlated with aspects of their contour (r = .44), shape (r = .49) and quality (r = .47). In other words, larger buildings tended to be isolated, have unique shapes, and be of high quality. Shape singularity also correlated with surface singularity (r = .43).

Among visibility components viewpoint significance and immediacy correlated (r = .47) probably because buildings tend to cluster around decision points where they also lie on the axis of vision. Between attributes of significance, correlations were low.

There were few correlations of any consequence between components of form, visibility, or significance with the exception of use singularity and size (r = .38), and use intensity and movement (r = .32).

Were a factor analysis to be carried out on these attributes, it is possible that clustering would take place across the components of form, visibility, and significance. However, the present clustering of attributes by their similarities rather than by their co-presence in the buildings of one particular city would seem, conceptually, to be more useful.

Building Attributes and Recall Frequencies

When the scaled attributes of buildings were correlated with the recall frequencies—maintained as continuous variables—the wide array of attributes that appeared to affect recall and their varying influence in the three different response situations were among the more interesting aspects of

TABLE 5
INTERCORRELATIONS BETWEEN BUILDING ATTRIBUTES

	FORM													VISIBILITY			SIGNIFICANCE		
	Mov. sing.	Cont. int.	Cont. sing.	Size int.	Size sing.	Shape int.	Shape sing.	Surf. int.	Surf. sing.	Qual. int.	Qual. sing.	Signs int.	Signs sing.	Viewpoint Intensity	Viewpoint Significance	Immediacy	Use Intensity	User Singularity	Symbolism
Movement int.	.55*	.17*	.08	.16*	.12	.23*	.19*	.18*	.14*	.01	.02	-.01	.06	.12	.15*	.20*	.26*	-.05	.04
Movement sing.		.27*	.13*	.25*	.31*	.32*	.34*	.29*	.31*	.17*	.05	-.24*	-.10	-.08	.08	.10	.32*	.16*	.10
Contour int.			.53*	.35*	.30*	.13*	.29*	.13*	.16*	.29*	.29*	-.14*	.00	-.22*	.16*	.22*	.11	.22*	.15*
Contour sing.				.44*	.38*	.21*	.34*	.10	.17*	.31*	.31*	-.22*	-.01	-.17*	.17*	.23*	.02	.32*	.16*
Size int.					.66*	.37*	.49*	.18*	.17*	.47*	.34*	-.30*	-.06	-.20*	-.06	.09	.14*	.38*	.23*
Size sing.						.36*	.44*	.24*	.23*	.32*	.38*	-.32*	-.08	-.14*	.04	.11	.11	.34*	.20*
Shape int.							.62*	.33*	.40*	.23*	.10	-.13	-.02	-.07	.02	.07	.13	.07	.03
Shape sing.								.33*	.43*	.31*	.22*	-.17*	-.01	-.11	.06	.09	.09	.24	.13
Surface int.									.68*	.30*	.14*	.01	-.01	.20*	.12	.22*	.08	.13	.01
Surface sing.										.23*	.13	-.08	.06	.13	.20*	.28*	.17*	.20*	.08
Quality int.											.39*	.00	-.01	-.21*	.09	.06	.21*	.21*	.11
Quality sing.												-.01	-.04	-.15*	.04	.08	.08	.15*	-.17*
Signs int.													.60*	.21*	.08	-.05	.01	-.36*	.11
Signs sing.														.13*	.06	.02	.02	-.12	.01
VISIBILITY: Viewpoint Intensity															.13*	.16*	-.14	-.21*	-.10
Viewpoint Significance																.47*	.26*	.07	-.01
Immediacy																	.12	.16*	.11
SIGNIFICANCE: Use Intensity																		.22*	-.11
User Singularity																			.27*
Symbolism																			

Correlations exceeding .138 are significant beyond the .05 level and are marked *.

the output. (See table 6.) Significant, though not high, correlations occur-
red between most of the attributes and recall frequencies, the only excep-
tions being those of signs and recency. The generally low level of the
correlations was to be expected where the buildings, numbering between
one and two hundred, were spread across fifteen miles of development
allowing any individual inhabitant to mention only a portion of them.
Where local inhabitants' knowledge of local buildings was examined, (not
reported here) correlations rose much higher.

Attributes of Physical Form

Of the attributes selected, the first five, movement, contour, size,
shape and surface rivalled each other for the highest correlations with
frequencies in the three different response situations, while the last two,

TABLE 6

CORRELATIONS BETWEEN BUILDING ATTRIBUTES
AND RECALL FREQUENCIES

Attributes	Map Recall		Verbal Recall		Trip Recall	
	Int.	Sing.	Int.	Sing.	Int.	Sing.
Form						
Movement	.34*	.29*	.25*	.34*	.35*	.26*
Contour	.26*	.30*	.18*	.16	.33*	.36*
Size	.25*	.24*	.28*	.29*	.38*	.35*
Shape	.21*	.23*	.22*	.30*	.29*	.41*
Surface	1.19*	.30*	-.08	.14	.23*	.43*
Quality	.15*	.10	.17	.09	.15	.16
Signs	-.06	.06	-.15	-.01	-.11	.03
Visibility						
Viewpoint Intensity	.20*		.08		.18	
Viewpoint Significance	.39*		.13		.38*	
Immediacy	.38*		.13		.37*	
Significance						
Use intensity	.36*		.32*		.35*	
Use singularity	.31*		.22*		.37*	
Symbolism	.07		.08		.05	
Recency	.08		.04		-.12	
Number of buildings in sample	188		122		104	

*Correlations exceeding .13 (map), .17 (verbal) and .19 (trip verbal) are significant
beyond the .05 level and are marked *.

signs and quality, appeared to have relatively low influence over recall. Interestingly, the most powerful identifying qualities in the map responses were those of movement, usually of people, and of contour, which isolated buildings from their surroundings. (See tables 2, 2a, and 6.) Both were more influential than the apparent size of buildings. In the free verbal recall however, size and shape rose in importance while contour diminished. The improved position of size in this context was to be expected, although there is no obvious explanation for the change in ranking between shape and contour. In the trip recall, the rise of surface and shape is worth remarking upon. When simulating the more concrete task of imagining a journey through the city, respondents focussed on what might be called the more sensorial attributes, either because the task emphasized these attributes or simply because the buildings lying along the road system possessed these attributes more than others.

Movement: Most of the movement associated with buildings was that of people, clustering around bars, lining up outside the cinema, children playing in the school playground. It is not surprising that the presence of people should excite attention. Even slight movements in the environments are noticed because they provoke curiosity or signal danger. Parked cars were treated in our ratings as potential activity, and other kinds of motion were recognized: smoke, flags, trees, and water. The fluctuating nature of this phenomenon, however, made it difficult to measure. A school would be empty for a good part of the time, and appear empty when the children were in classes; a stadium might be used heavily just once a week. Scores were usually measured by the peak periods of apparent movement. Intensity of movement was to some extent correlated ($r = .32$) with the objective number of people using a building, the differences being accounted for by buildings which displayed a different level of movement externally from that within. A school with a hidden playground would appear to be less used than a store or a heavily trafficked street corner.

Contour: Sharpness of boundary defines a building from its ground making it stand out even, according to these correlations, if it is a small building. But an isolated house in a field of isolated houses may be less noticeable than the end house on the row. Singularity therefore adds to noticeability, a proposition which seemed to be borne out by its usually higher correlations. Many of the more important community buildings in the city, particularly the newer ones, such as the steel mill, several schools, the medical facilities, and the churches, were isolated and received their due attention, but in the older indigenous parts, even public buildings like the Consejo Municipal were joined to others, which made them difficult to identify.

Size: Building size was measured by the apparent height and bulk of a building as seen from its approach view. These qualities were not easily perceptible, however, in the densely built-up areas of town such as the center of San Felix. Clear perception of size depended frequently on isolation. Singularity too was influential. In the planned parts of Puerto Ordaz, large buildings like schools and industrial sheds stood out more in residential areas where their size contrasted with the context, than in commercial areas where sizes were more comparable. Size, like movement, correlated moderately ($r = .38$) with use singularity.

Shape: In the first scalings, simplicity of shape was thought to be an imageable characteristic (Lynch, 1960); but when it received low correlations, the scale was inverted and complexity was taken as the high measure with slightly more success. Each end of the simplicity/complexity spectrum seemed to catch some attention. Simplicity allows for quicker perception in a time constraining situation, one possible reason for wide knowledge of the General Electric warehouse at the main intersection in Puerto Ordaz, where an equally visible building was more complex in form but virtually ignored. In other contexts, complexity captured attention. The Hotel Cunucunuma and various schools, which were externally articulated into blocks, and complex industrial structures like the steel mill and the smaller cement plant, were perhaps noticeable because of their isolated situations and simpler contexts. Unique shapes were especially striking. The arches of the Protestant Church, the barrel-vaulted roofs of the steelworkers Syndaco in Puerto Ordaz, and the La Salle School in El Roble stood out in the city dominated by rectangular buildings. The dominant influence of shape singularity in the trip responses ($r = .41$) may well dismay those who condemn the search for novel forms in buildings, for it shows that they did succeed in attracting attention.

Surface: Brightness, coarseness, and complexity of surface can be salient characteristics of a building, but the buildings of Ciudad Guayana were predominantly white while the landscape was green and brown making it difficult to establish a single calibrating system. The higher singularity correlations confirmed that relative rather than absolute brightness was the more distinctive characteristic. The dike of Macagua Dam, brown and rocky, dissolved into the landscape, when it would have been noticeable against a white housing area; green trees which would have dissolved into the landscape were dominant in the white plaza.

Quality: Quality was a catch-all category for the use of expensive materials, careful landscaping, cleanliness, and good condition, and usually correlated with social status. But since buildings of the same quality grouped together in areas, quality seemed to be a noticeable characteristic

only when at the boundary between areas of different social level, like the Puerto Ordaz supermarket near to the Castillito boundary which was used by those from Castillito, or where individual improvements like the new bank buildings in San Felix were taking place in an older environment. These instances were not sufficient to make quality in general an important differentiating characteristic of buildings in the city, although it certainly distinguished residential areas from each other.

Signs: Verbal signs were the primary means whereby shopkeepers, gas stations, and advertisers hoped to attract the customer's attention. Doctors, lawyers, architects, and public facilities had signs outside their offices too, but they were usually quiet in form and modest in size. The low correlations received by signs were unexpected. The names of many buildings must have been learned through their signs, yet the signs themselves did not appear to influence attention patterns. The reason perhaps was that the more significant and large community buildings did not have large signs on them. The churches were unsigned, schools and hospitals were dignified by discreet lettering over their entrances, often invisible from the street, and the steel mill had no sign at all: it did not need one. The smaller commercial buildings displayed the largest signs, but only those that were well located gained attention.

When regression analyses were made of the intensity and singularity components, the multiple correlation coefficients (singularity R = .43, and intensity R = .44) were comparable (table 7). This appears to confirm that the recall of a building does depend as much on its relation to the context as on any absolute qualities. However, despite the intercorrelation of intensity and singularity measures among the components, their correlations

TABLE 7

MULTIPLE CORRELATION COEFFICIENTS BETWEEN BUILDING ATTRIBUTE CLUSTERS AND RECALL FREQUENCIES

Attribute Clusters	Map Recall	Verbal Recall	Trip Recall
Form Intensity	.43	.41	.56
Form Singularity	.44	.39	.56
Form attributes	.50	.49	.63
Visibility attributes	.47	.15	.48
Significance attributes	.44	.38	.45
Total attributes	.67	.59	.71

with recall frequencies varied considerably among these components. For instance, singularity of shape and surface appeared to be more important than their respective intensity, while in other attributes intensity and singularity held comparable correlations.

Visibility Attributes

Of the three components of visibility, viewpoint significance and immediacy achieved the highest correlations both in map and trip recall. Visibility by large numbers of people was not by itself sufficient for identity. (See table 6.)

Viewpoint Intensity: Viewpoint intensity, measured by the number of people, both auto and pedestrian travelers likely to pass the most prominent viewpoint of the building during a typical day, was an approximate measure, since accurate flow data did not exist (Hassan, 1965). Although most of the highly mentioned buildings lay on main roads or in the most intensely used centers, viewpoint intensity received a relatively low correlation due to the number of insignificant and obscure buildings lining the main roads of the city, which were in the path of vision but unnoticed.

Viewpoint Significance: The readiness of travelers to see buildings at decision points in the city, whether at intersections, bus stops, bends, or ferry crossings was confirmed by this high correlation. Many quite diminutive and insignificant buildings are situated around these points; the small Hotel Palua at an acute bend in the main road, the gas stations at the intersections in Puerto Ordaz and in El Roble, the Firestone billboard at the turn before San Felix, all received high frequencies on the subject maps, while similar and sometimes identical looking buildings in other locations went unmentioned.

The travelers' need to identify decision points or to describe them to others when giving directions, appeared to be so strong that they were forced to search for distinctive features, even when there were no obvious ones around, because decision points had high information content (Attneave, 1954). If they were unnamed, as in Ciudad Guayana, then the nearest nameable feature became the commonly used symbol for that intersection, e.g., "the turning by the Hotel Palua."

Immediacy: The immediacy of a building to the viewing or circulation system, its closeness and centrality in the cone of vision were also attention-drawing attributes. With the automobile traveler spending a great deal of attention on the road ahead, buildings that happen to be in front of his line of vision stand a high probability of being seen so long as they

are minimally differentiated and are not too far away. No buildings in Ciudad Guayana at this time were consciously placed on view lines, but some occurred there by chance. The radio pylon on the Ciudad Bolivar road, the Hotel Palua in El Roble, the General Electric in Puerto Ordaz were all on the axis of vision or crossed the axis while the traveler was turning, and consequently received high attention.

Attributes of Use and Significance

The relatively high correlations of use intensity and singularity were to be expected. (See table 6.) The low correlations of symbolism can be explained by the fact that the symbolism rating was conceived as a boost only given to symbolic elements that had not already received a high score for use intensity. Had the symbolism score incorporated use intensity and singularity scores, it might have achieved a higher correlation.

Use Intensity: Like assessments of viewpoint intensity, these measurements were approximate. Information was gained from a survey of industrial and commercial establishments, but customer use had to be projected from expert opinion in most cases. There were difficulties in assessing daily and weekly use similar to those affecting the scaling of movement, and similar scoring rules were employed. Indirectly used features like water towers were also rated, although at a reduced level. This measure of user intensity received high correlations, although no higher than some of the visibility attributes. Clearly, many respondents were looking at the environment as a setting for activity, but this was not the only or dominant environmental attitude.

Use Singularity: The measure of singularity partially describes the range of users and the realm of a facility. As there was only one hospital for instance, it was important to the whole community and all would potentially need to use it. However, certain unique facilities like the Protestant Church, or the Country Club, were only open to limited groups. The measurement of singularity depended, too, on the level of categorization. Schools were not unique, but a high school was. To be meaningful, then, singularity required a fine level categorization. The correlations suggest that singularity was slightly less important than intensity as a functional attribute, perhaps because many of the singular functions like the cemetery, the brick kiln, or cock-fighting ring were not sufficiently dominant or visible to be noticed.

Symbolism: Since highly used buildings could always be termed significant and to avoid duplication of scalings, symbolism was only measured for significant buildings that were not already intensely used. The measure included buildings of economic significance like the Macagua Dam,

buildings of political significance like the political party headquarters, and landmarks of historical significance like the statue of Simon Bolivar in the main plaza. It received very low correlations in these circumstances, confirming the dominance of use intensity as an indicator of significance, but not clearly refuting the importance of symbolism.

Other Attributes

Three other attributes were considered influential: recency, publicity, and nomenclature. Of these, only recency (r = .08) was scaled and correlated. In most cities, the newer buildings are outstanding and well recalled, but in Ciudad Guayana, this was not the case. Since most buildings were new, a recent building or activity was only distinguished when it was already imageable or significant.

Cuttings from the local newspaper, the *Bolivarense,* for three months before the interviews, were scanned and the places mentioned in the news were noted. Although they were not scaled the more important new buildings and events were mentioned, suggesting that some correlation might have been found between publicity and selection. Specific and unique names, too, were more identifiable than those which were duplicated, like the Bombas, so that singularity of nomenclature might also have achieved some correlation with recall frequencies.

Multiple Correlations of Form Visibility and Significance with Recall Frequencies

The multiple correlation coefficients of the three groups of component attributes with recall frequencies were positive and comparable, particularly with the frequencies from the map and trip recall responses (form, R = .50 and .63; visibility, R = .47 and .48; significance, R = .44 and .45). (See table 7.) The role of visibility (R = .15) dropped in the verbal recall correlations.

The variation in multiple correlation coefficients agrees with the general impression gained from the interview responses, that attention to environmental attributes varies with the question asked or the task simulated. The subject maps appeared to describe their operating knowledge of the city, their commonly used routes, destinations, and the elements they encountered on their journeys. As such, their general selection of attributes was similar to those in their trip recall task, although the correlations of component attributes differed (table 6).

The map responses in Ciudad Guayana may also have been a purer expression of this operating knowledge than is usual in subjective maps since there existed no public map to assist or interfere with their direct

recall of urban experience. The low multiple correlation for visibility attributes with the verbal recall frequencies suggests that in this task the inhabitants were employing their more general knowledge of the city, depending on physical form and general significance more than on personal travel. Of course, their objectivity was still relative.

Hence, in a city where the physical, visual, and significance patterns were incongruent, not only was the inhabitant's knowledge incongruent with the pattern of community significance (the R's between significance and recall were never more than .45) but the inhabitant's operating and general knowledge were also revealed as incongruent. A person's immediate experience of the city differs from what he knows in general about the city, and this in turn differs from the objective physical, social, and functional city. Such incongruencies may be especially troublesome to those who depend more on the environment for their urban knowledge, probably newcomers, migrants, youngsters, visitors, and others learning about the city for the first time.

Multiple regression equations take advantage of all chance relations obtaining in an array of data, so that until these coefficients are cross-validated with another sample we cannot be certain of these relationships. Further, the multiple correlation coefficients still only account for under fifty percent of the variance and therefore cannot be considered to offer a high level of predictability. However, the level of correlation suggests that the attributes under consideration possess predictive qualities which gives promise for successful cross-validation in the future.

As a matter of interest, the regression formula for predicting building recall of free map recall responses was A = 2.5 (contour singularity) + 3.1 (movement intensity) + 1.5 (viewpoint intensity) + 2.9 (immediacy) + 1.75 (viewpoint significance) + 2.87 (use intensity) + 3.5 (use singularity) - 29.25.

Since these regressions were not standardized, the weightings given to the attributes are not comparable. Nevertheless, the attributes and weightings happen to agree in general with the individual correlations, and it is notable that the formula picks form, visibility, and significance attributes.

The Attributes of the Urban Environment and
Some Implications for a Theory of Urban Knowledge

The evidence supports the contention that all the elements of the urban environment—point, linear, and areal; landmarks, nodes, paths, edges and districts (Lynch, 1960) are known for some combination of their form, visibility, use, and significance. To illustrate this in simple terms, consider a hypothetical urban environment and see how an individual inhabitant and the larger population gain their knowledge of it. Each of the four sets of
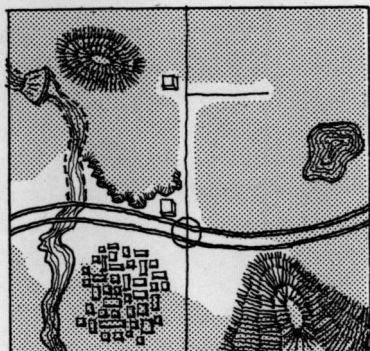
Figure 1A. Distinctive Physical Environment—Potential and Visible to Inhabitant
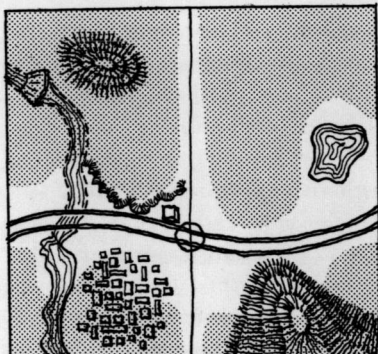
Figure 1B. Distinctive Physical Environment—Potential and Visible to General Public
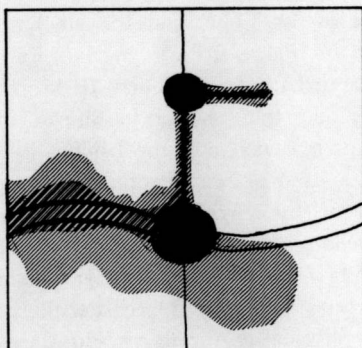
Figure 2A. Visible Environment of Inhabitant
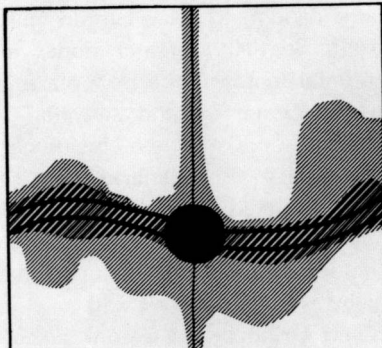
Figure 2B. Visible Environment of General Public
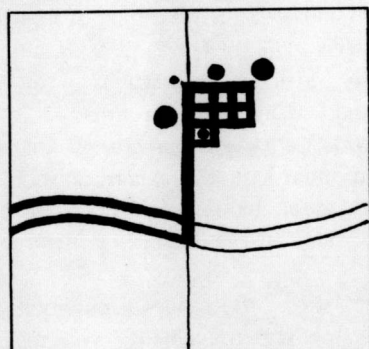
Figure 3A. Used Environment of Inhabitant
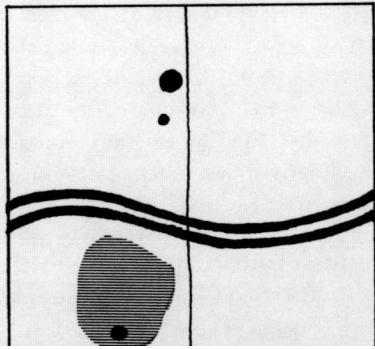
Figure 3B. Used Environment of General Public

diagrams (figures 1 to 4) describes one set of environmental attributes within which separate diagrams explain individual and public perceptions.

Figure 1A describes the distinctive elements of our inhabitants' potential environment. The inner core of this diagram is the environment usually visible to him (see figure 2A), the outer shaded elements being seldom if ever seen by him. Distinctive features, especially those in the inner visible core, stand a high probability, through their distinctive attributes, of capturing his attention and being recalled. As we know, only parts of districts, boundaries, rivers, and other features may possess these qualities of imageability, and these are all that have been shown. The same features form the potentially distinct environment of the general public but the pattern of visibility changes (figure 1B).

In Ciudad Guayana, the distinctive landmarks included billboards, watertowers, radio pylons, and a hundred or so buildings, up to very large landmarks like certain hills, the Llovisna Falls, and the steel mill itself. Spatially distinct nodes included the Plaza Bolivar in San Felix, colonial in form, the new plaza in the Centro Civico of Puerto Ordaz, the traffic circles on the Avenida Guayana, and the new bridge across the Caroni; some of these, including the Centro Civico and the bridge, functioned both as landmarks from the outside, and as spatial reference points when entered. Although most elements of the circulation system were chameleon-like in character, a few channels possessed distinctive and continuous form. They included the Avenida Guayana, a four-lane divided highway; the railroads and electric powerlines; and at the largest scale, the Rivers Orinoco and Caroni, although the physical continuity of the Caroni was frequently interrupted by confusing rapids. Several of these linear elements, especially the rivers, acted simultaneously as defined edges or barriers. The terrain was also sharply divided and bounded by ridges, spurs, and quebradas, but in only a few places, at the north and western edges of San Felix, which were bounded by water, and around the camps of Puerto Ordaz, was there a clear edge to urban development. The landscape, being complex but not dramatic, was generally difficult to grasp as a set of spatial units, although the urban designers made a brave attempt and identified the Caroni and San Felix "bowls" among other spaces. Urban development was also scattered and amorphous, with the exception of the Casco in San Felix, a distinctive colonial square-block area, and some of the new housing areas of the western side of the Caroni, with their identical house types.

Figure 2A of the visible environment shows the range of our inhabitants' vision from the usual paths of action and movement, with more immediate areas adjacent to his line of travel, on the axis of his vision and at high attention areas around significant decision points. Distinctive ele-

ments that fall within this visible zone will stand a higher probability of being seen and known, very much like the features revealed by a car's headlights on a night-time journey. Determination of general visibility (figure 2B) will depend on public surveys of urban travel patterns and the identification of major viewpoints.

In Ciudad Guayana, these features were determined mostly by their visibility from the main road system. Telling instances of its influence were the emphasis in our subjects' maps on road details like curbs and traffic islands at intersections, small buildings at decision points, small bridges over the railroad lines, a river edge, or the visible side of a housing area. Several distinctive features—and significant ones—fell outside this range: buildings like the steel mill itself; the hospital; the ports; both plazas, which were invisible from main traffic movement; the railroads; power lines; and rivers except where crossing the main road; vast areas of the landscape including the Caroni Falls and rapids; and the hinterland of the urban areas, which includes several new but hidden residential developments.

The third diagram (figure 3A) of the inhabitant's used environment is that which generates his visual field and covers all those features which are the immediate settings for his activities and travel, be they local establishments, stores, or meeting places, his intelligence and decision points, regular paths of movement, or well-known local territories criss-crossed by his own short journeys. Once in familiar territory, the inhabitant can find his way around without conscious effort, regardless of whether it is clear or confused. Such a territory, like the local neighborhood, was often thought of more in social and action terms, of friends and neighbors, and frequented paths and places, rather than physical forms and entities. On our subject maps, the entire street system was often drawn more as a network of personal paths and decision points than as a system of channels.

The publicly used environment (figure 3B) depends more on the intensities of flow and densities of activity of the whole population. In our example the possible incongruencies between our individual's use of local stores and the public use of facilities has been dramatized for clarity. For our inhabitant the local school is not directly used, but seen as a building of community significance (figure 4A).

This used world is of course part of the inhabitant's visible environment and the distinction between an immediate setting for behavior and part of the environment that is being viewed is in many cases difficult to make. For instance, in this interpretation, a road intersection is defined as the used environment and a building viewed from it as part of the visible environment.

In Ciudad Guayana, the places of intensive use included the larger industrial plants, commercial, and community facilities. Heavily used out-
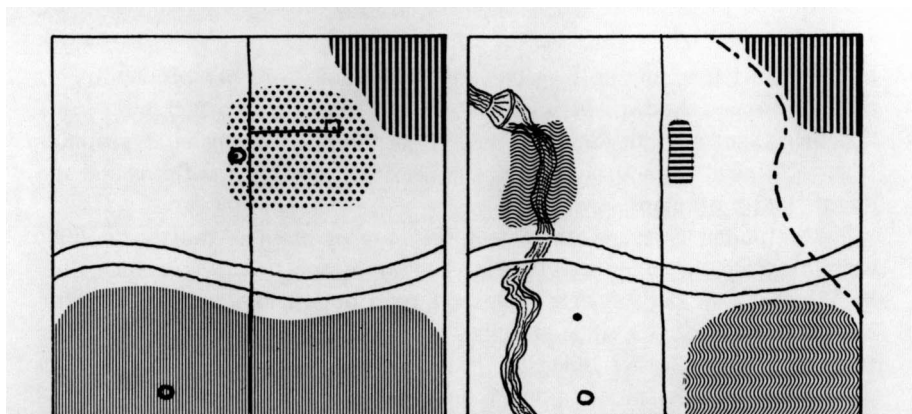
Figure 4A. Potentially Significant
Environment to
Inhabitant

Figure 4B. Potentially Significant
Environment to
General Public
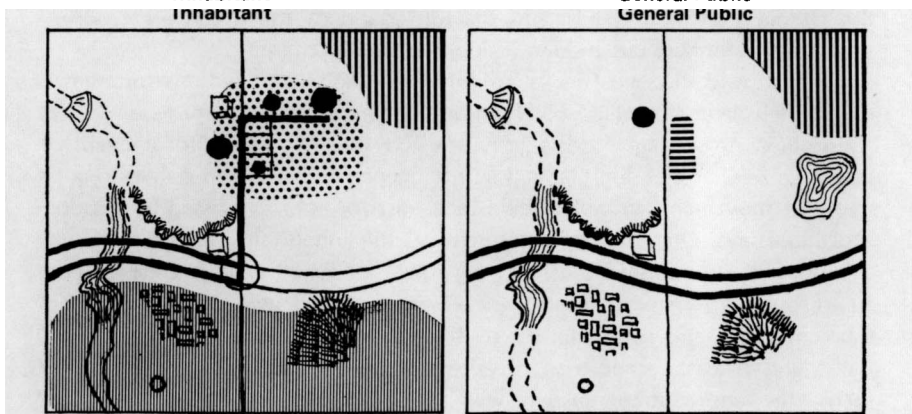
Figure 5A. Probable Urban Knowledge
of Inhabitant

Figure 5B. Probable Urban Knowledge
of General Public

door spaces included the plazas, the streets through commercial areas, especially in San Felix and Castillito, and major traffic intersections; the main east-west road was the most heavily trafficked pathway, and the commercial zones again were the most intensely used areas. Certain barriers were primarily barriers to movement. The difference between a ferry and a bridge was a good example. The aggravating delays experienced while waiting for a ferry, and the dramatic change of vehicular mode made it a memorable action event in addition to being a multi-sensory transition from congestion and noise to quietness, coolness, and visual serenity. When replaced by the bridge, the river ceased to be a movement barrier, but remained a visible one.

The fourth pair of movement diagrams (figures 4A and B) describe the significant environment, those aspects of the city or landscape which are significant for economic, social, political, historical, or aesthetic reasons. The inhabitant learns about this environment from previous experience and from his social communications system, from the mass media and other information sources, as well as from personal use. If it is invisible, he often infers its configuration from the cues and signs he encounters in his travel about the city—many of which may, of course, be inaccurate. As an environment becomes significant, it usually acquires a name, often a careful choice to connote the proper social status, community function, or economic market.

The significant environment is frequently communicated to the inhabitant indirectly and in verbal language. So accustomed are most people to categorizing the environment verbally, elements which have no names seem to be more difficult to perceive and recall. This seemed especially so for the larger districts. In the figures 4A and B, elements that are not necessarily visible, distinct, or even used have been mentioned. The inhabitant's own house, club, street, and neighborhood may lack distinguishing qualities to an outsider, but are significant to him. He may picture another part of town or the local school primarily for social characteristics that he has read about in the local newspaper, and he may be particularly conscious of a socially prestigious neighborhood next to his own. For the general public, the diagram describes potentially significant elements: economic, political, ecological, historical, and future areas, more of which may be physically evident to the normal traveller in the city.

Determination of potential significance would have to depend on available economic, social, and other data together with an assessment by some representative sample of the public and special interest groups of relative significance and value.

Several elements of Ciudad Guayana were of economic, social, or historical significance without being visible, distinctive, or heavily used. The hydroelectric dam, of fundamental economic importance, was hidden to the south of the city and heavily guarded against visitors. Power lines and railroads, the light industrial park, and extensive steel mill, were all of significance although the former were only indirectly or lightly used, and most were invisible to the ordinary inhabitant.

Social significance differentiated all kinds of elements. The socially prestigious Country Club was remote, unseen, and open only to an exclusive few, yet was widely known. Other elements, too, possessed high social status: some of the other clubs, a certain street in El Roble which was flanked by larger *quintas* (villas), and some of the newer and better residential areas. Los Monos, the subject of a recent police raid, was known

for different social reasons. The influence of social differentiation was well-instanced by the case of the battered fence which separated the Orinoco Mining property from the rancho area of Castillito. Although it could scarcely be seen and offered no barrier to traffic along the road between settlements, those below it in Castillito mentioned it several times on their maps, an instance of directional perception due to social differences. Highly-used meeting places like the plazas and main streets were naturally of high social significance. The plazas and their statues were historically important, too.

Finally, figures 5A and B illustrate the probable urban spatial knowledge of our inhabitant and that of the general public.

The archetypal pattern of a citizen's urban knowledge takes the form of three concentric zones: the used, the visible, and the hearsay world beyond. When our subjects in another part of our interviews were asked if they had used, seen, or only heard of certain buildings, they placed them in these categories without difficulty. However, the uneven and incongruent pattern of form, visibility, use, and significance breaks up this neat spatial model of urban knowledge.

The diagrams show a motley conglomerate of elements. For the individual inhabitant, the locally used and significant environment is supplemented by the visible and distinctive elements that he encounters in his more frequent travels, and some items of community significance that he has learned about from his social communications media, although he has never visited them. On the other hand there are many omissions such as the lake and western hill, neither of which he has visited; the future park; the ecologically unique zone; and the architectural masterpiece, about which he has never heard. The elements known by a large majority of the public are differently distributed. They include the most intensively used places, the most visible and distinct, and the best publicised significant elements.

These diagrams outline the basic types of information that should be gathered for any environmental prediction of urban knowledge. It should be reiterated that such a survey would serve the limited purposes of urban communication and knowledge, but knowledge, after all, affects our expectations and satisfactions, our urban actions and choices. With inadequate or inaccurate knowledge about the cities we live in, our choices are limited.

Designing with Attributes

The evidence suggests also that the urban vocabulary of architects and urban designers, while it may serve some purposes, is in fact substan-

tially incongruent with the public's urban vocabulary. For buildings alone, the site plan's emphasis on size and shape and its inattention to the location and behavior of users, to visibility, contour, and social significance are a cause for concern. It may be argued, and often is so, that experienced designers can read through a site plan and infer what it will be like in reality. This may be so for the designer's perception of reality, but can hardly predict the population's perception. Moreover, should new and inexperienced professionals be trained in a vocabulary that fails to describe a large part of the impact of their designs?

If we could develop a reliable predictive tool, how would it affect the methods of urban planners and designers? First, in Ciudad Guayana, the importance of attributes like visibility became more apparent to the planning team after these interview results were presented, so that important buildings and roads were located more carefully with this characteristic in mind.

A good predictive formula would give the planner and designer a vocabulary of urban attributes, which could be used in several ways. He could coordinate urban form and visibility with the active experience of the inhabitant, so that the latter could find his way more clearly around the city. He could also coordinate form, visibility, and action with community significance to create a more meaningful city (Steinitz, 1967). Further, if the designer wanted to encourage a sense of community, preserve privacy, or stimulate change and new interactions, he could propose which elements and attributes might be seen by or hidden from particular population groups making some clear and distinct, others ambiguous. We do not, of course, know from this research whether such changes would affect more than knowledge. The language could be used for a wide array of purposes. Assuming that the community could decide which buildings were significant and should be known by the population, no easy matter, it should be possible to adjust the attributes of form and visibility to enable each building to achieve the desired level of recognition.

Such a predictive model for building recognition could also be of dramatic use to the individual architect or developer for they might well wish to know what impact their design or investment would have on the general public and on particular population groups. The advertising agencies are already aware of this. A cautionary word is, however, in order. These findings relate only to one city in a particular stage of development. Although the variables of identity are probably the same for all cities, their relative weightings are bound to be different.

None of this is to say that designs of or controls over the form of buildings should be exerted solely for purposes of communication or

recognition. Clearly there can be functional and hygienic purposes, and there can be other kinds of aesthetic control for achieving, say, coherence or contrast. But controls over recognition and communication are important and have been neglected. Many of these techniques have been under consideration in Ciudad Guayana and some have already been used in its design.

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