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Styles and Methods of Structuring a City

Center for Planning & Development Research: Institute of Urban & Regional Development
University of California, Berkeley

Reprint No. 61

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STYLES AND METHODS OF STRUCTURING A CITY

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How do people relate different parts of the city to each other, how do they "place" themselves within the urban environment; in other words, how do they mentally structure the city? Kevin Lynch (1960) found that his subjects structured different cities by different elements. The inhabitants of Boston usually organized it as a set of loosely related districts, Los Angelenos tended to organize their downtown by its gridiron street system, while the people of Jersey City used the main roads and the view of Manhattan. Lynch also found that elements were related in varying degrees of accuracy, from those which were loose and free to those which were firmly interconnected or rigid.

In Ciudad Guayana, the new city in Eastern Venezuela, referred to in an earlier article in this journal (Appleyard, 1969b), we carried out a study of the inhabitants' maps of their local areas and the whole city, to explore further the several ways in which people structured cities and to see whether

AUTHOR'S NOTE: *This article is extracted from a chapter of a forthcoming book, which covers other aspects of urban knowledge and its implications for urban design. A summary of this research can be found in Donald Appleyard (1969a). The author wishes to acknowledge the assistance of Annamaria Sant'Anna and Carl Steinitz in this research and the MIT-Harvard Joint Center for Urban Studies for their support.*

different groups in the population would structure the same city in different ways. The city at the time of the interviews possessed certain unique features that distinguished it from other cities (Figure 1). Thirty thousand people were living in a number of settlements located along a main road which meandered from the west to the east by the steel mill, past an airport, through a middle- and high-income new community, Puerto Ordaz, through a squatter settlement, Castillito, across a ferry, alongside and through the scattered ranchos of El Roble, to the old colonial-type rectilinear village of San Felix. The city therefore was generally linear with no dominant center. It was disrupted in its structure by the River Caroni, and was flanked by the River Orinoco to the north and the Caroni Falls to the south. Each part possessed a somewhat different internal street system. Puerto Ordaz was made up of neighborhood units; Castillito had a ladder-like system; El Roble was amorphously spread around an acutely angled main road; and San Felix was a rectangular grid.

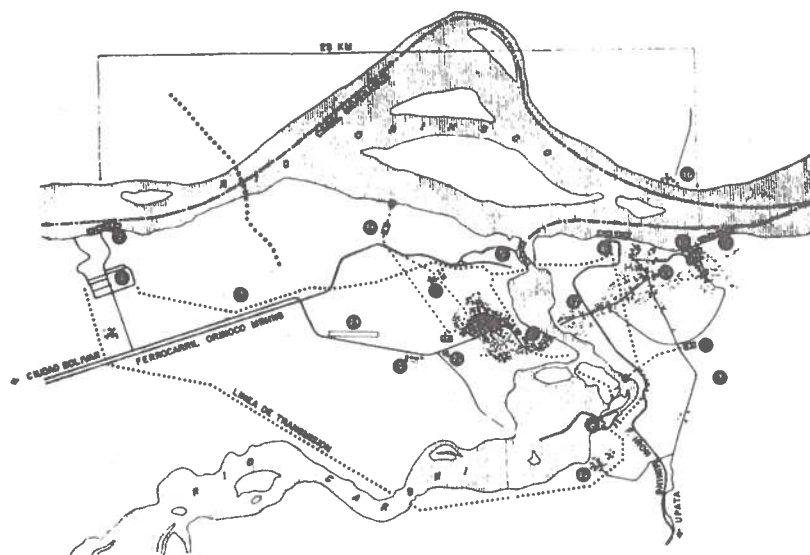
The city was also unique in that there was available no public map to assist (or contaminate) public perception of the city's structure.

DESCRIPTION OF RESPONDENTS

As described in the earlier article (Appleyard, 1969b), seventy-five respondents were drawn from Puerto Ordaz, Castillito, El Roble, and San Felix. In each area seventy-five units were selected and a quota system to ensure sufficient number in each age, sex and education cell was established. The total sample (see Table 1; Appleyard, 1969b) 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 years of age. Approximately one-half had received only a partial or complete primary education. One-sixth had been in the city under one year, and one-half lived there for less than five years. Over one-half travelled predominantly by bus, and about one-quarter each travelled by car or por puesto (collective taxi running along a set route). Two-thirds were male and one-third were 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

Among many other questions, respondents were asked to draw a map of the whole city between the steel mill and San Felix. They were also asked to draw a map of their local area. The questions follow:



Industries	Communities	Public Services
1. Steel Mill	9. Puerto Ordaz	17. San Felix Port
2. Port	10. Country Club	18. Acueducto
3. Light industry	11. Castillito	19. Acueducto
4. Light industry	12. Dalla Costa	20. Oleoducto
5. Orinoco Mining Port	13. El Roble	21. Airport
6. Iron Mining Port	14. San Felix	22. Micro-wave Tower
7. Light Industry	15. Campamento Caroni	
8. Macagua Hydroelectric Dam	16. Los Barrantos	

Figure 1. Existing urban development.

The map describes the existing settlements and infrastructure in 1964.

Free Map Recall (General Map) Suppose now that here is San Felix and here is the Steel Mill, please draw a map indicating the points and places in the city you have just mentioned (places they could remember verbally). After that add any other important features that come to mind.

Free Map Recall (Local Maps) Please make a map of () and (), including schools, the police stations, hospitals, markets, shopping areas, churches, places where people meet, the Concejo Municipal, CVG offices, political party offices and any other things which you think important to mention.

Each question naturally biased the responses slightly. The first, by stipulating the extremes in the city may have emphasized its linearity, the second by asking for facility locations probably emphasized landmarks, but the variety of the results suggests that the effects were slight.

TYPES OF MAPS

We analyzed the inhabitants' maps in two ways, first simply by scanning all the maps and grouping those that appeared to have similarities, second by looking at collections of maps produced by contrasting subject groups. The maps appeared to group along two dimensions, according to the *type of element* predominantly used, and according to their *level of accuracy*, that is their congruence with the objective plan of the city.

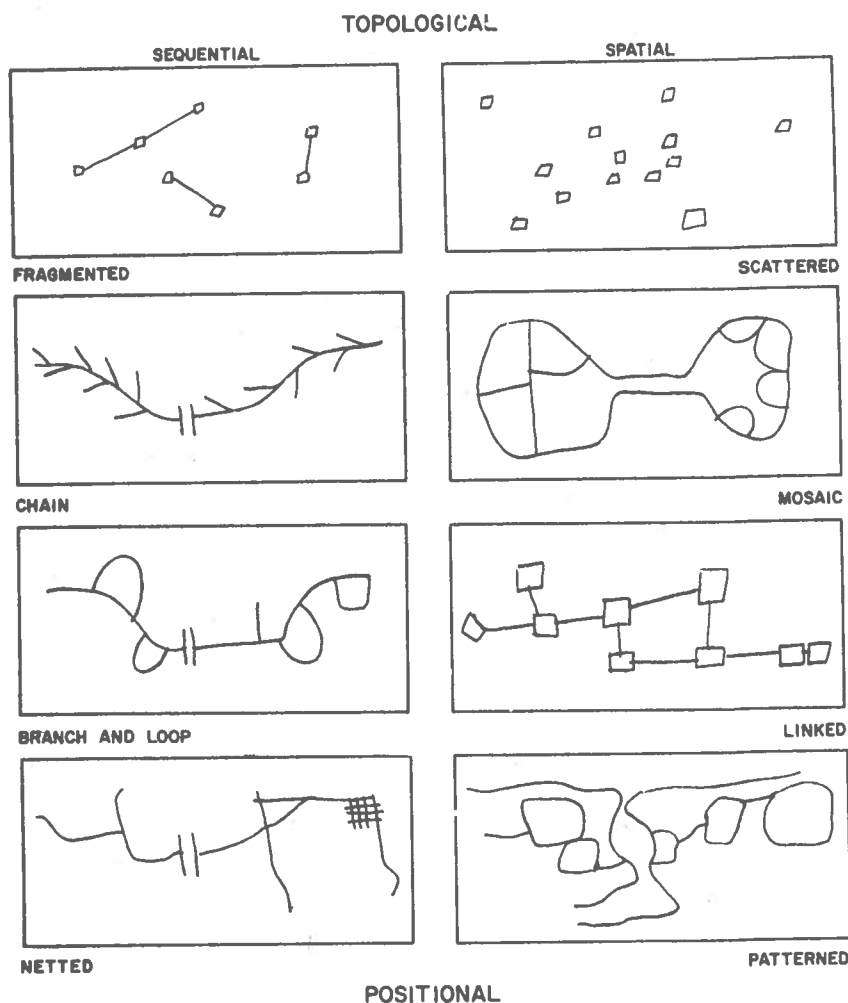
The maps predominantly used *sequential elements* (roads) or *spatial elements* (individual buildings, landmarks, or districts). The most accomplished maps employed combinations of both elements. In the sequential maps the parts were more obviously connected, and the connections were dominant. In the spatial element maps, parts were quite often scattered over the map and connections were apparently incidental.

Within each of these map types, four subtypes were identified. Within the sequential type there was a fairly clear gradation from the most primitive-looking, which contained *fragments* of sequences, through *chains*, *branch*, and *loop* maps to more complex and usually more accurate *network* maps. The spatial maps were more difficult to place neatly on any gradient. A number were *scatter and cluster* maps of dots, points, or names, and these appeared to be the most primitive. Another set were *mosaic* in form, still others were *linked*. The final group, the more accurately *patterned*, was the only spatial group that stood out definitely as more sophisticated and assured. Figure 2 diagrammatically illustrates the dominant types, and Figure 3 reproduces one example of each type either from a local or a citywide subject map. Table 1 shows the frequencies of each map type as mentioned by several of the respondent groups. Approximately 75% of the maps drawn concentrated primarily on the circulation system and were coded as sequentially dominant maps. Approximately 25% were spatially dominant maps.

SEQUENTIALLY DOMINANT MAPS

Fragment. The most primitive kind of sequential element maps consisted of fragments of paths or lists of elements unconnected to each other and frequently out of serial order. About eight percent of all maps were of this type.

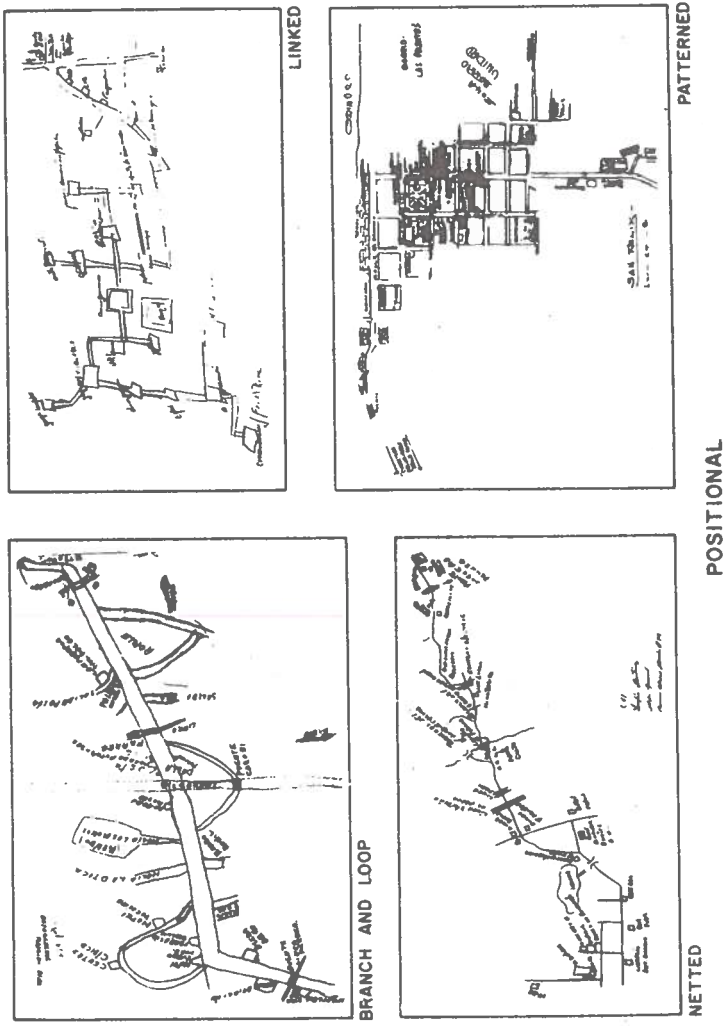
FIGURE 2
MAP TYPES^a



a. Reprinted from *Planning Urban Growth and Regional Development* (1969), by Lloyd Rodwin and Associates, p. 437. By permission of MIT Press.

Chain. An equally simple but more schematic type of map treated the major east-west road with all its intersections, right-angle turns, and other bends as a straight line. Some of these maps were no more than lists of places

Figure 3 (Continued)



a. Reprinted from *Planning Urban Growth and Regional Development* (1969), by Lloyd Rodwin and Associates pp. 438-9. By permission of MIT Press.

TABLE 1
STRUCTURAL STYLES

MAP TYPE	RESIDENCE			EDUCATION		FAMILIARITY		AGE		TRAVEL MODE		SEX		SELECTED OCCUPATIONS																							
	TOTAL SAMPLE	COUNTRY CLUB	PUERTO RICO	CASTILLITO	EL ROBLE	SAN FELIX	CARONI	NONE	PRIMARY	SECONDARY	UNIVERSITY	UNDER 6 MOS.	6 MOS. - 1 YR.	1 YR. - 5 YRS.	OVER 5 YRS.	UNDER 20	21 TO 30	OVER 30	CAR	FOR RUESTO	BUS	MALE	FEMALE	BUSINESSMAN	PERSONAL SERVICES	PROFESS. JONALS	STUDENTS	UNEMPLOYED	BUSINESS	OFFICE WORKERS	HOUSEWIVES	SKILLED WORKERS					
LOCAL SETTLEMENT MAPS	5	22	6	4	5	2	-	18	2	4	12	-	14	5	3	3	4	7	1	4	4	3	8	10	8	8	15	10	10	17	9	10					
	17	-	15	23	16	12	20	18	19	16	14	57	7	15	13	19	12	16	12	10	20	12	11	10	20	23	15	30	10	17	24	15					
	19	22	17	19	18	14	-	18	18	21	12	-	43	14	19	19	21	14	17	21	17	22	10	20	20	15	20	10	17	19	15						
	12	23	11	10	11	6	20	9	6	16	19	-	16	8	11	8	13	15	12	12	9	14	6	20	20	15	20	10	17	7	22						
	70	88	68	73	74	32	40	72	63	72	66	86	78	66	61	69	64	66	66	61	71	70	59	70	50	69	73	10	20	6	5	22					
	8	-	9	2	8	14	-	9	8	6	8	10	7	10	7	8	10	6	10	9	7	7	8	12	10	9	10	10	10	6	1	32					
	10	-	11	6	2	5	8	-	2	4	4	14	1	2	2	2	2	2	4	12	1	4	4	6	10	15	5	10	10	11	15	4					
	4	-	8	2	3	8	-	-	2	4	4	14	1	2	2	2	2	2	4	12	1	4	4	6	10	15	5	10	10	11	15	4					
	1	-	8	2	3	8	-	-	2	4	4	14	1	2	2	2	2	2	4	12	1	4	4	6	10	15	5	10	10	11	15	4					
	28	11	32	18	21	46	-	13	33	23	20	14	25	23	26	28	29	31	25	24	24	26	27	30	18	28	20	50	34	32	16	4					
	6	-	8	5	2	60	9	6	3	15	-	7	6	3	10	7	4	-	4	-	4	26	22	30	18	28	20	50	34	32	16	4					
	104	99	100	99	100	98	100	99	102	100	101	100	99	99	98	102	102	101	101	98	100	99	100	100	100	100	100	100	100	100	100	100	102				
WHOLE CITY MAPS	8	35	9	10	8	2	-	18	4	9	19	-	21	8	7	7	6	10	8	7	5	6	11	10	8	8	3	10	20	6	15	4					
	13	22	13	12	13	12	-	9	14	9	15	14	21	12	11	13	15	10	15	9	13	10	17	24	20	18	13	10	10	11	15	7					
	21	-	25	19	24	18	50	9	24	21	8	14	23	21	22	21	19	19	12	23	25	18	25	12	10	15	20	10	10	11	15	7					
	15	22	11	13	11	24	10	16	18	25	8	43	36	14	21	22	21	17	21	16	24	23	13	41	20	8	23	30	10	28	29	26					
	78	11	73	77	77	68	40	11	16	23	14	19	12	15	12	15	12	15	13	7	15	16	11	16	15	15	20	20	20	20	19	19					
	6	11	9	4	5	6	-	9	6	10	7	8	7	8	7	7	7	7	6	8	7	7	7	7	50	61	79	50	50	73	10	28					
	11	8	15	11	10	10	-	9	12	7	12	14	21	11	8	8	13	18	19	14	5	11	8	18	20	8	5	20	11	11	15	4					
	4	11	4	-	5	4	10	-	5	3	4	3	3	3	2	1	1	1	2	3	1	4	4	6	10	10	5	10	10	6	5	4					
	1	-	2	-	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
	23	22	23	19	24	26	20	18	26	19	24	14	21	20	23	16	25	26	29	34	13	23	23	24	40	31	21	20	40	28	24	19					
	101	99	101	99	101	100	99	101	99	101	100	99	99	99	98	100	99	98	98	100	99	100	100	100	100	100	100	100	100	100	100	100	101				
	211	9	53	51	38	50	10	11	107	67	26	7	14	91	99	71	52	88	52	43	95	140	71	17	10	13	40	10	10	13	41	2					
NUMBER OF RESPONDENTS WITH MAPS																																					

SOURCES: General Maps or Local Maps where no General Map was drawn. Percentages out of 211 respondents who drew maps.

encountered on this route, others swept the line around in a curve, a small concession to the complex curves and bends of the actual road system. About thirteen percent belonged to this category. Another twenty percent were more accurate chain-type maps attempting to show all major bends, but they were undeveloped laterally. Some of these showed impressionistic bends, merely to indicate that the road contained them somewhere.

Branch and Loop. More laterally developed maps contained loops and branches as common outcrops from the basic linear system. The loops were often drastically simplified versions of circuitous routes, as in the case of the route up to the Centro Civico in Puerto Ordaz. Twenty-one percent of the maps belonged to this type.

Network. More complete road systems, often incrementally and laboriously constructed, and in many cases accurate representations of the true city were produced by only about fifteen percent of our sample. A few of these maps were schematically laid out, with the rivers outlined and the roads correctly located. These may have been drawn by the few subjects familiar with a map of the city.

SPATIALLY DOMINANT MAPS

Scatter and Cluster. The most primitive spatial maps contained elements like individual buildings or establishments which would be grouped together freely without any drawn connections. Frequently just the names were distributed over the sheet. Not all of these maps were inaccurate. Some distributed the elements more or less in their correct spatial positions. This technique was used more in local areas where the direction and distance of each point appeared to be positioned in relation to the home which was the place of interview. As many as eleven percent of the respondents constructed scatter maps; six percent clustered the elements.

Mosaic. The enclosure of districts by schematic boundaries and their division into subdistricts, whether shopping centers or residential neighborhoods, created maps which were less specific or accurate than the scatter maps, yet plotted out major zonal relationships. These looked more like planners' zoning or neighborhood-unit maps. Only four percent belonged to this group.

Link. Places or districts were connected with schematic linkages, which occasionally stood for parts of the road system. The spatial units were, in any case, dominant. In maps of the whole city, only one percent were found to employ this method, but in their local maps five percent used this method.

Pattern. These were the more complete and the most accurate spatial maps, with the outlines of areas and rivers as dominant features. Like the network maps, they demonstrated a subject's ability to handle and draw maps, but comprised a mere one percent of our sample.

To summarize, the most common maps were the *chain* type, the *branch and loop*, and the *network*, followed by the spatial type *scatter* map. The dominance of sequential maps confirms the importance of the path system as a structural organizer of the city.

But it must be emphasized that we do not gain a complete understanding of city structuring purely through examination of subject maps. The task of drawing a map can tell us a great deal about some structuring methods, but tells us little about structuring through visual imagery, association, or symbolism. More on this later.

What these different map types do emphasize is the extraordinary variety of methods that people use to conceptualize cities. The meaning of these results and their implication for planners and urban designers will be difficult to assess.

STRUCTURAL ERRORS (TABLE 2)

In addition to the classification of map types a number of common errors were recorded. The spatial relations between nine zones of the city were assessed on each subject map. These relationships were recorded as *faults* where there was a break between zones, and as *bends* where the relationship was spatially distorted. In cases where zones were misplaced on the map or where the positions of two zones had been switched, the errors were coded respectively as *mislocations* and *zone reversals*. *Landmark mislocations* were recorded when a landmark was placed incorrectly in a wrong zone, and spatial *distortions* of the road system within each zone were noted. The most common type of error was the distortion of roads or zones.

GROUP DIFFERENCES IN STRUCTURING (TABLES 1 AND 2)

To examine groups differences more closely, the maps were grouped by the population types that drew them. Approximately twenty maps were selected as representative of each group. Hence sets of maps were selected for each level of education, familiarity, and age and for each traveller type, sex, and occupation.

Education. Many of the structuring differences between the educational levels can be explained by a varying ability to conceptualize. Clearly, few of the uneducated had ever been asked to draw a map before and several,

TABLE 2
STRUCTURAL ERRORS^{a b}

Structural Errors	Total Sample	Education				Familiarity				Travel Mode			Sex	
		None	Primary	Secondary	University	Under 6 months	6 months to 1 year	1 year to 5 years	Over 5 years	Auto	Por Puesto	Bus	Male	Female
	%													
Zone faults and bends per zone	3.3	2.7	5.3	3.1	1.8	2.7	1.5	3.8	5.0	6.0	4.6	3.1	3.3	3.3
Zone reversals per zone	1.5	—	2.2	1.1	—	5.5	—	1.3	1.8	1.7	2.5	0.4	1.6	1.0
Zone mislocations per zone	1.7	5.5	2.2	1.1	1.1	8.3	7.9	9.6	9.1	1.7	2.5	0.9	1.2	2.7
Landmark mislocations per zone	0.8	1.0	3.0	0.5	—	—	0.7	0.7	0.9	0.2	1.1	0.6	0.6	1.2
Road distortions per zone	7.4	8.0	8.9	6.0	6.7	8.9	3.5	7.2	7.9	3.5	8.3	5.4	7.3	7.6
Average errors per zone	2.9	3.4	4.3	2.4	1.7	5.1	2.7	4.5	4.9	2.6	3.8	2.1	2.8	3.2
Respondents	168	4	79	66	18	4	7	77	80	31	69	68	115	53

a. The number of errors for each of nine city zones were recorded from the General Maps. Then the average number of errors per zone was calculated as a percentage of all those who responded to the General Map, including those from the Country Club and Campo Caroni. Total: 168 Respondents.

b. Some of the subgroups contain only small numbers of respondents.

especially the females, required some persuasion before embarking upon the task. The fact that many of the uneducated used only the bus system did not help matters, but this was not the sole contributor to their difficulties.

The less-educated employed no common method of structuring, although it was dominantly sequential. They tended to draw either starkly simple or very complex maps, with most of them being simple. Commonly, the parts were inaccurately related. A very low percentage were able to draw coherent *network* or *pattern* maps. The most common maps of those with some primary education were of the *chain* type (37% in local settlement; 38% in the whole city). Errors of all kinds—faults, bends, reversals, mislocations, and distortions—diminished with education. Those with primary education committed an average of 4.3 errors per zone, those with a college education committed only 1.7 errors.

Many would build up their maps along the paths of movement, hesitating at intersections as if mentally travelling the journey. This incremental piecing together inevitably led to errors in the larger context. They seemed to use no extra check to adjust relationships to the map as a whole. Parts of the city would be misplaced or reversed in relation to the road. The steel mill would be located south instead of north, and in some cases the whole map was drawn in a mirror-image. Many of these errors were minor as long as the main relationships were accurately established, but the lack of spatial accuracy could lead to severe distortions. A difficult intersection or a forgotten curve could throw the whole map system askew. Frequently, their drawings would run off the sheet or be distorted or skewed to keep within the confines of the paper.

Assembling concepts was another difficulty. The rectilinear street system of San Felix was seen as a series of separate turnoffs with no interconnection, rather than as a schematic grid. Mismatches between visual and verbal information were also discovered. In one case, a school in Castillito was located on the site of another school in Puerto Ordaz. Evidently, the individual had heard of the first school, seen the other school, and made the wrong association. Mismatches like these can occur in anyone's experience, but they were more prevalent among the less-educated groups. The nesting of small elements within large ones was also found to be a difficult task. Frequently, the settlements through which the main road travelled would be seen as separate from rather than embracing the road. Their maps tended also to be noninferential, predicting very little beyond direct experience. Several subjects drew zig-zag paths through San Felix without extending them to form the gridiron system. The river edges too would only be drawn where they were actually seen from the road.

The maps of the less-educated conveyed a strong sense of subjective experience. Most of them were flow-dominant, describing their own journeys

rather than the physical form of the transportation system. Even the people who distributed points in a scatter pattern seemed to be placing them in relation to their position at the time of the interview.

The more educated groups were able to draw the city more objectively, fitting their maps together more coherently, inferring more about the city, even from limited experience (Bruner, 1957)). They would sketch out the rivers and lay out the rectangular street pattern of San Felix as schematic concepts, and the maps would be well fitted to the sheet. They seemed better able to fit perceptual experience to plan concepts. Even so, only about twenty percent could produce network maps.

Inference did not always lead to accuracy. After three months in the city, a newly arrived European engineer drew in three railroad lines instead of the actual two. His previous experience told him to expect a railroad linkage between the steel mill and the Orinoco mining port, a connection that did not yet exist. Abstraction and inference enable an inhabitant to cope with larger areas and more complex environments more rapidly and with greater mastery, but he may miss the detail in his skimming of the information given.

Temporal familiarity. The newcomers were a widely diversified group, so we expected very different degrees of structuring in their first year. Mobility would affect the rate at which they came into contact with the city; conceptual abilities would affect their speed of acquiring knowledge; travel mode would influence their methods of acquiring knowledge.

Nevertheless, there were some consistent variations along the dimension of familiarity. With increasing familiarity, the use of spatial elements became slightly more common. Newcomers produced overwhelmingly sequential maps (eighty percent). Older residents did the same to a lesser extent (sixty percent). First-year subjects produced more restricted maps. Fifty percent could draw only their own side of the Caroni River. On the other hand, newcomers of six months to one year made less errors per zone in the parts of the city that they could draw than longer-time inhabitants, indicating that their level of interest and concern was probably high.

Age. There were no striking differences between age groups except for a tendency of the under-twenties to emphasize sequential elements.

Spatial familiarity. Spatial elements were more predominant in maps of inhabitants' local areas than those of other parts of the city. Even so, both were drawn in predominantly sequential style. There were more spatial element local maps in the old town of San Felix (46%) and the new community of Puerto Ordaz (32%) than in the other parts. This was probably due to the gridiron plan of San Felix and to the confusing street system of Puerto Ordaz.

We postulated that the classic type of urban schema would be spatially well developed in the home area, with strands of sequential knowledge stretching out into other areas of the city. The local area would be accurately positioned and well fitted together, the distant, unfamiliar world becoming progressively more amorphous, topological, and less accurately related, with locations imprecise and distances vague. While this was true to a degree in Ciudad Guayana, well-structured islands of knowledge in parts of the city other than local areas were common, particularly for those who lived outside the main centers.

Travel mode. Variations in travel mode seem profoundly to influence structuring style. About one-half of our sample used buses as their dominant form of transportation, while one-quarter used cars or *por puestos*. There were, however, problems in distinguishing the influence of travel mode because most people used more than one mode. For the purposes of more precise analysis, we sorted out those that travelled solely by bus and solely by car.

Of the subjects who travelled only by bus, eighty percent were unable to draw a coherent map of the urban road system. All the maps found in this group were either scattered or fragmented. Although these subjects were low in education, they differed from an equivalently educated set who used *por puestos* or travelled by car.

There were several bus services in the city. In 1964 the buses travelled from the eastern terminal south of San Felix along an indirect route through several barrios before reaching the plaza in San Felix. They continued westward along an old route in El Roble rather than along the new shortcut, then directly across the river and through Castillito following another circuitous path through the camps of Puerto Ordaz. The sign "Circumvalacion" on the front of the buses aptly described the journey. Add to this the difficulty of seeing through the front window of a crowded bus, the agonizing slowness of bus travel in Ciudad Guayana, the absence of announcements at each stop, and the form of the bus riders' maps can easily be understood. This kind of experience seemed inevitably to lead to fragmentation and the creation of islands of knowledge with only schematic, vague, or unknown links in between.

All the maps drawn by the selected group of car-only travellers presented a coherent and continuous system. In the total sample of those who drew maps, however, distinctions between the travel groups were not as sharp, probably because each group was to some degree mixed. For both bus and automobile groups, sequential maps were more common, but among the citywide maps, sixteen percent more auto-dominant travellers than bus travellers drew spatial element maps, and thirteen percent more bus-dominant

travellers than auto travellers drew sequential element maps. Automobile-dominant travellers developed their citywide maps more broadly, relying less on the individual routes, while bus travellers kept very much to repeated sequential journeys. Those travelling by collective taxi produced maps slightly more similar to the auto-dominant travellers, but less accurate than those of the other groups.

Sex. Females had been expected to rely more on spatial structuring, given their predilection for security and containment. In their local maps they showed this predilection more than males (70% to 59%). Females also made more errors in their maps. These differences may be due to their relative immobility in the city. There was also reluctance among many female respondents to demonstrate knowledge that they were later found to have. Ability to draw a map seemed to be taken as an unfeminine quality.

Occupation. The more accurate maps were drawn by business executives and skilled workers, the least accurate by housewives and professionals. The elements used by business executives, however, were dominantly spatial, while those of the skilled workers were overwhelmingly sequential, an interesting contrast in styles between maps that were equally accurate. The better-educated business executives were perhaps able to place elements positionally through acquaintance with maps of the city, while the skilled workers learned through regular daily travel. The poor showing of professionals has no obvious explanation.

CONCLUSIONS

There appear to be several important dimensions to the structuring of cities. Some are confirmed by the findings, others I shall only hypothesize here.

- (1) We know already from Lynch's work that cities can be understood and structured by different elements, either sequential or spatial. In the classification presented here Lynch's paths and nodes are considered sequential elements, and landmarks, districts, and edges group more or less under spatial elements. In Ciudad Guayana the sequential mode was dominant.
- (2) By comparing field surveys of *form*, *visibility*, *use*, and *significance* patterns (Appleyard, 1969a) with the inhabitants' maps, it was apparent that they were using each of these attributes to structure the city. Areas of similar physical character were frequently grouped

together. At points on the road system where visibility was low, directional clarity on the maps was frequently lost. The influence of personal use on structuring was clearly evident in the chain maps which straightened out all physical kinks to create a continuous personal linkage between parts of the city. As for the influence of social and functional significance, one of our interviewers can serve as an illustration. She insisted on associating her neighborhood with the more prestigious but distant Puerto Ordaz, than with the physically adjacent but less prestigious rancho settlement of Castillito. Perceptual distance from a similar social area is apparently less than actual distance, while perceptual distance from a lower social group is greater than actual distance.

In addition, the power of names and naming systems over the mental structuring of cities should not be underestimated. Several maps were no more than distributions of names.

- (3) Three fundamental methods of relating parts of the city emerge from the map interpretations and the field surveys: the *associational* method which depends on the differentiation, association, and patterning of functional, social, or physical character; the *topological* method, which depends on continuity and juncture of movement and character; and the *positional* method, emphasizing spatial placement, direction, and distance. The characteristics of these methods will be pursued in a later article.
- (4) People appear to structure the city in *varyingly schematic* ways. Many subjects strove to fit their urban knowledge into a coherent schema. However, given the disjointed nature of the street system, extreme simplification was necessary. The meandering rivers and even the main east-west road connection with its acute-angled bends and intersections were frequently drawn as straight lines. Other subjects worked more incrementally, seemingly unable to grasp the larger structure of the city, adding sections of road or area together, or simply setting down disjointed fragments with little regard to overall placement. Schematic maps that attempted to grasp the pattern of the city in some simplified and systematic way were found both at the lowest levels of competence where they suffered from oversimplicity and at the highest levels where maps were laid out in close congruence with the actual urban pattern. The better maps appeared to use a combination of deductive and inductive methods.
- (5) There was also evidence of *inferential structuring*. The European engineer who predicted, wrongly, the three railroad lines, epitomized this influence. Those who drew a gridiron street system for San Felix were inferring also, probably from much more limited experience. Inferential structuring depends on a person's previous experience of

cities, and the unconscious personal rules about environmental relationships that develop from that experience. As long as a city structure conforms to that of other cities, the inhabitant knows it will be relatively easy to structure. It is the unique aspects that confound the newcomer.

The influence of inferential structuring makes it very difficult to disentangle images derived from direct experience from those based on *interpretations* of given experience. It will be necessary to learn more about our generalized mental models of cities before the mental structures of a particular city can be properly assessed.

- (6) The differences in the structuring of population groups appear to be due more to *cognitive differences*, *travel mode*, and *familiarity* than to other personal variables.

The subjective map was found to provide a rich source of information about urban perception, particularly when correlated with field surveys of the visible, functional and social character of the city. Maps picture spatial relationships which are very difficult to verbalize. That they do not usually indicate visual imagery, however, makes it important to devise other survey methods to fill out exactly how people structure their cities. In more recent work on U.S. cities, we have used photo-sorting, film recognition, and actual travel through the city as part of the interview task, together with questions on route planning, route choice, and route imaging. We have also found it helpful to trace the personal histories of how people learned to travel around a city.

Here is not the place to draw the implications of such structuring methods for planners and other environmental designers. Suffice it to say that when planning, transportation, and design professionals plan new towns and cities, they usually structure them so that they read well at an altitude of 30,000 feet. The methods used by ordinary people on the ground are perhaps more relevant and, apparently, more interesting.

NOTE

1. These methods take off from Piaget's writings on the child's conception of space (Piaget and Inhelder, 1948) with his *topological*, *projective*, and *euclidean* phases of space conception. The difference in structuring types at the city scale occurs because his children were performing small scale space-structuring tasks.

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