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The Environmental Quality of City Streets: The Residents' Viewpoint

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THE ENVIRONMENTAL QUALITY OF CITY STREETS: THE RESIDENTS' VIEWPOINT

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Field interviews and observations were carried out on three similar San Francisco streets with differing traffic levels to determine how traffic conditions affected the livability and quality of the street environment. All aspects of perceived livability—absence of noise, stress, and pollution; levels of social interaction, territorial extent, and environmental awareness; and safety—were found to correlate inversely with traffic intensity. Traffic increases were also accompanied by the departure of families with children from these streets. Responses were nevertheless muted for a number of probable reasons, including environmental self-selection, adaptation, and lack of a target for resentment. The study is presently being replicated on a larger scale. Meanwhile, interim policies and standards are proposed.

Protests and research about the environmental and social impact of transportation systems have paid most attention to the problems created by new freeways through urban areas. But while these are the more dramatic instances of traffic impacts, the rapid growth of vehicular traffic has swamped residential streets in cities across the United States and in other countries. Traffic on city streets may affect as many, if not more, people than traffic on freeways. In San Francisco, approximately 60 percent of the city's major streets (those with a daily traffic volume of over 10,000 vehicles) are lined with residences.[1]

Studies of urban streets (such as the current TOPICS program of the Federal Highway Administration) have concentrated almost exclusively on increasing their traffic capacity, through devices such as street widening, signalization, and one-way streets, with no parallel accounting of the environmental and social costs of these alternatives. Wilfred Owen (1969) recently directed attention to the role that city streets play in the environmental quality of cities as "the main corridors and front parlors" of the city, but even he did not point out that people also have to live along city streets. To our knowledge, the only empirical studies of life on city streets, apart from some studies of traffic noise and a Michigan study of the economic and environmental effects of one-way streets (Michigan, 1969), have been those carried out in Britain since the Buchanan Report (Her Majesty's Stationary Office, 1963 and Chu, 1971).[2]

The investigation reported here is a small-scale attempt to identify the environmental concerns of those who live on city streets in San Francisco. It is a pilot study using observation and open response interview techniques, and does not pretend to statistical significance. The results however are suggestive. The project grew out of the San Francisco City Planning Department's concern over increasing traffic on the city's streets and the side effects of street widenings and other proposed changes in the street system. It was one of a series of studies of environmental conditions made in San Francisco during 1969 and 1970 (San Francisco City Planning Department, 1969–70).

Study Streets

Of the street blocks selected for a general study of street living three streets are reported upon here to serve as a model of the research approach and because they contrast the effects of traffic on similar types of streets. The street blocks chosen were adjacent north-south residential streets in the northern part of the city (figures 1, 2, 3).

Traffic

The major environmental differences between the streets were their traffic levels. The first street, which we shall call HEAVY STREET, was a one-way street with synchronized stop lights and a peak hour traffic volume (at the evening rush hour) of 900 vehicles per hour (average 15,750 vehicles over twenty-four hours). The second street,

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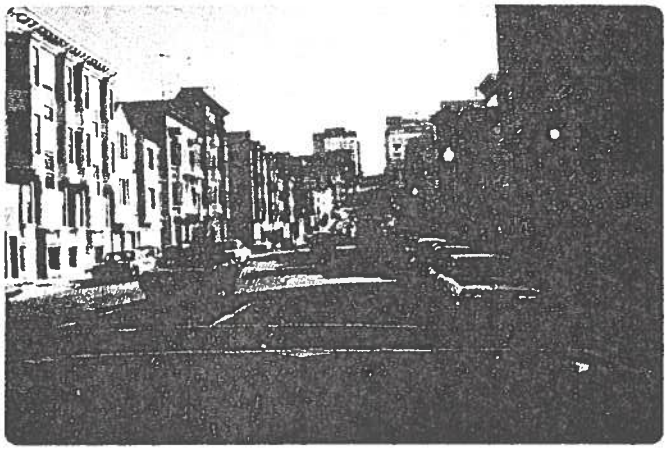

FIGURE 1 *HEAVY STREET*

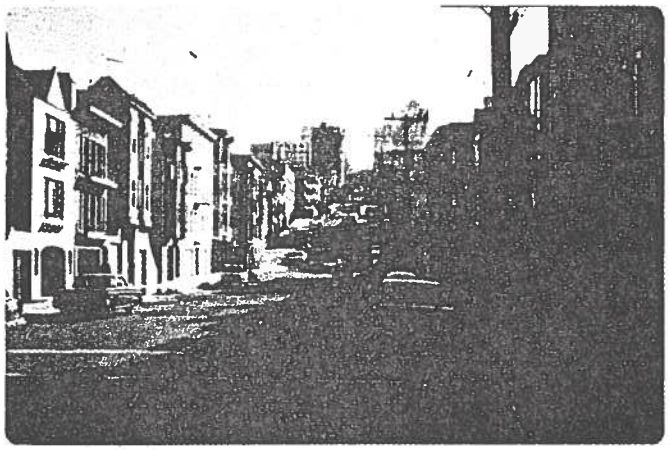

FIGURE 2 *MEDIUM STREET*

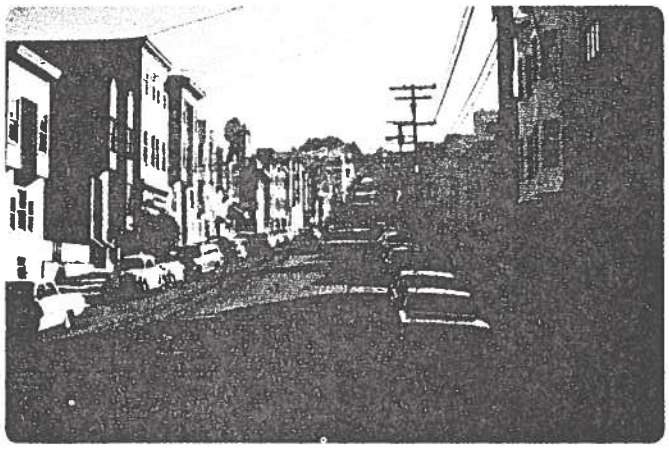

FIGURE 3 *LIGHT STREET*

MODERATE STREET, was a two-way street with a peak traffic flow of 550 vehicles per hour (average 8,700 vehicles over twenty-four hours); the third street, LIGHT STREET, had a volume of only 200 vehicles at peak hour (average 2,000 vehicles over twenty-four hours).[3]

Speeds on all streets could rise to forty-five miles an hour or more but only on HEAVY STREET was the speed controlled by the synchronized lights. Traffic volumes had increased on HEAVY and MODERATE STREETS ten years earlier when they were connected to a freeway at their southern terminal. Through traffic was dominant on MODERATE and HEAVY STREETS, and traffic composition included more trucks and buses on HEAVY STREET than on the others.

Population

The three study blocks were part of a residual Italian neighborhood that also included other white residents and a small but growing Oriental minority. By social class, education, and income the streets were relatively homogeneous. Contrasts, however, occurred in age, family composition, ownership, and length of residence.

LIGHT STREET was predominantly a family street with many children. Grownup children were even returning to bring up their own children there. One-half of the people interviewed were homeowners, and the average length of residence was 16.3 years. HEAVY STREET, at the other extreme, had almost no children on its block. It was inhabited mostly by single persons of all ages from 20 years upward, with many old people, especially single elderly women. The average length of residence on HEAVY STREET was 8.0 years, and people were nearly all renters. Rents were also somewhat higher on HEAVY STREET, averaging $140 a month among our respondents, whereas those on LIGHT STREET averaged $103. MODERATE STREET stood in between. Average length of residence here was 9.2 years and the average rent was $120. (See table 1.)

Environment

The three streets were typical San Francisco streets, with terrace houses or apartments built up to the building-line, very few frontyards and very few gaps between the houses. The architectural style ranged from Victorian to modern. The buildings were finished in either wood, stucco, or brick and were of white or light colors. They were pleasant-looking blocks. The streets were each fairly level, with a slight gradient to the south. They were close to various shopping and community facilities.

Study Design

Two sources of information were used in the study. Detailed interviews lasting about an hour were held with twelve residents on each block, composed of three equal age categories, the young (under twenty-five) the middle aged (twenty-five to fifty-five), and the elderly (over fifty-five). This was not a very large sample but since they

represented about 30 percent of the households on each block, their attitudes were probably representative of those on the three blocks. Second, systematic observations and, where possible, objective measurements of pedestrian and traffic activity on the streets were carried out.

The study design stemmed from earlier papers by Appleyard and others (Appleyard and Lynch, 1967; Appleyard and Okamoto, 1968) which proposed environmental criteria to be used in transportation system design. The criteria identified in the earlier studies were hypothetical in nature and for this investigation were slightly modified to cover the probable concerns of those living on urban streets. Five major criteria categories were employed to describe the character and day-to-day use of the street and the concerns and satisfactions of the residents. The interview was introduced as a survey of what the resident thought of his street, inviting suggestions for its improvement. The residents were not told that we were primarily interested in the effects of traffic.

The criteria categories were:

Traffic hazard: concerns for safety in the street associated with traffic activity.
Stress, noise, and pollution: dissatisfaction with noise, vibration, fumes, dust, and feelings of anxiety concerning traffic.
Social interaction: the degree to which residents had friends and acquaintances on the block, and the degree to which the street was a community.
Privacy and home territory: the residents' responses to intrusion from outside their homes, and the extent of their sensed personal territory or turf.
Environmental awareness: the degree to which the respondents were aware of their physical surroundings and were concerned for the external appearance of the buildings and the street.

Each question in the interview was related to one

TABLE 1 *Street Profiles*

Street Characteristics:	HEAVY STREET	MODERATE STREET	LIGHT STREET
Peak hour traffic flow (vehicles/hour)	900	550	200
Average daily traffic flow (vehicles)	15,750	8,700	2,000
Traffic flow direction	one-way	two-way	two-way
Vehicle speed range (mph)	30-50	10-45	10-35
Noise levels (percentage of time above 65 decibels at the sidewalk)	45%	25%	5%
Accidents (per annum over a 4 block length)	17	12	. . .
Land uses	Residential (apartment blocks, apartments)	Residential (apartment blocks, apartments, single family homes), corner store	Residential (apartments, single family homes), corner store, small business
Street width (feet)	69	69	69
Pavement width (feet)	52	41	39
Sidewalk width (feet)	8.5	14	15
Average building height (no. of storeys)	3.5	3.0	2.5
Interview sample:	**HEAVY STREET**	**MODERATE STREET**	**LIGHT STREET**
Mean household size (no. of people)	1.5	2.6	2.7
Percentage renters	92%	67%	50%
Mean household income ($1,000's)	6.6	8.1	10.0
Mean income/member of household	4.4	3.1	3.7
Mean number of school years completed	14	13	15
Mean length of residence (years)	8.0	9.2	16.3
Mean rents ($ per month)	140.00	120.00	103.00

Source: Traffic statistics and accident counts were obtained from the San Francisco Department of Public Works, Traffic Engineering Section. All other information came from interviews, summer 1969.

of the above categories, though some answers had relevance to more than one. The answers were independently rated on a five-point scale as "environmental quality" ratings by the interviewer and another member of the study team according to a general description of each criterion. Disparate judgments were discussed and a consensus rating was eventually recorded. No attempt was made to weight the responses in terms of their overall importance to the residents although this report emphasizes the main points of concern for the residents as expressed in the interviews. To make these findings more understandable we have graphed the responses in cartoon form.

So far, a public report on the study has met with considerable response in San Francisco. The general concerns of the study, and many of the individual conclusions, have been featured in the local press and on television. Furthermore the officially adopted San Francisco "Urban Design Plan" (San Francisco, City Planning Department, 1971) incorporates many of the recommendations for limiting through traffic on residential streets and creating "protected residential areas."

TRAFFIC HAZARD

Accident counts were equally high on HEAVY and MODERATE STREETS (means of seventeen and twelve accidents per year over a four-block length).

The danger of traffic was of concern to inhabitants on all three streets, but especially so on HEAVY STREET (ratings 3.7, 3.8). (See table 2.) These findings are not surprising, since the need for "safe intersections" was the most repeated concern in a concurrent citywide survey of city residents (Kaplan et al., 1969).

HEAVY STREET is a one-way street with synchronized stoplights which enable bunches of vehicles, already with momentum from traveling downhill, to travel through at speeds of up to fifty miles an hour. The fast speeds were frequently mentioned in the responses. The very heavy traffic volumes on HEAVY STREET made it unsafe for children, and even for people washing their cars. For residents trying to manoeuver out of their garages, a one-way street has advantages over a two-way street, since the driver only has to look one way, but getting a car into a garage can be more difficult since the driver either has to swing across the traffic flow or pull to one side and wait for a lull. Excessive speed was the cause of most of the perceived traffic safety problems, especially on HEAVY STREET. Residents, seeing a large number of cars speeding down the hill, would wait for someone to make a false move or would listen for the screeching of brakes. Several residents wanted the speed limit on HEAVY STREET reduced.

LIGHT STREET, with only a small amount of through traffic, had problems of a different nature. It tended to attract the occasional hotrodder who was, in some instances, a greater menace than the steady stream of traffic on HEAVY STREET. He appeared without warning, often jumping the stop signs at intersections, and was extremely dangerous for children playing in the street. Another problem on LIGHT STREET was the temptation to park where it was immediately convenient. Delivery trucks often parked on the corner when making deliveries to the grocery and blocked the view down the cross street for motorists approaching the intersection.

Residents of MODERATE STREET perceived less safety problems arising from traffic than did the residents of HEAVY STREET. However, they were concerned about traffic dangers. As one respondent put it, "There have been some accidents and I am taking precautions."

Apart from the direct effects of traffic on the feelings of safety, there were some indirect effects. The continuous presence of strangers on HEAVY STREET, even though they were in automobiles, evinced some feelings of fear. One young housewife had frequently been "hassled" from passing cars, and some of the older ladies on HEAVY STREET were "afraid to stop and chat."

As can be seen from the aggregated ratings, there was a consistent trend through all age groups to consider LIGHT STREET as being safe, MODERATE STREET as being neither safe nor unsafe, and HEAVY STREET as being unsafe.

STRESS, NOISE, AND POLLUTION

Measurements of noise levels were made on all three streets. The sound levels were determined through the use of Sound Survey Meters, utilized at four periods during a weekday; early morning (6:30 to 8:30 a.m.), late morning (11:00 a.m. to 12:30 p.m.), late afternoon (5:00 to 6:00 p.m.), and early evening (7:00 to 8:00 p.m.). In each measurement period, fifty consecutive measurements were made at fifteen second intervals at corner and midblock locations on each street. To translate these measurements into a useful measure of average conditions, the percentages of time that the noise exceeded certain A-weighted decibel levels [dB(A)] were calcualted. From these we computed a traffic noise index,[4] a recognized measure of noise problems, which can be used to

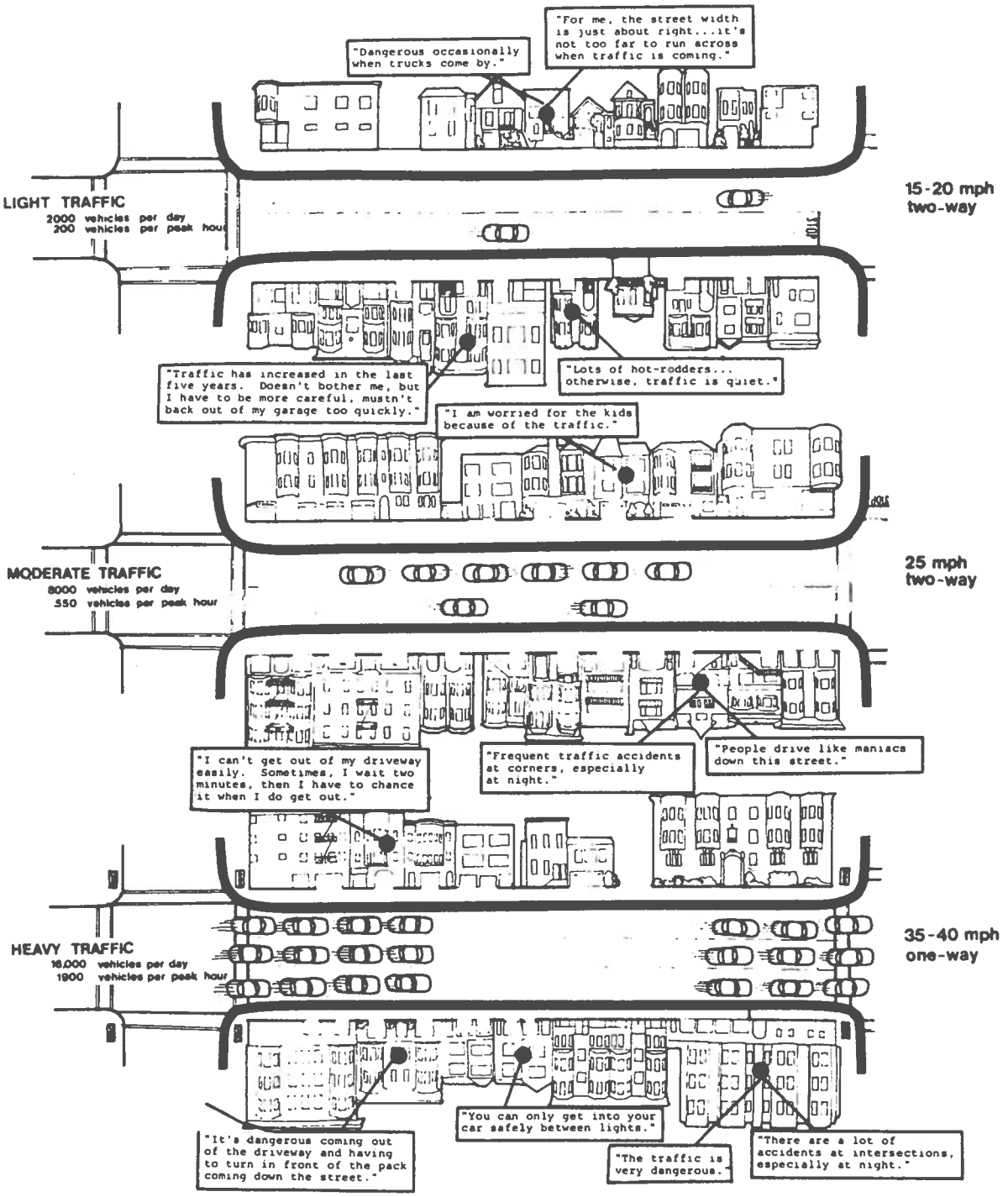

FIGURE 4 *Traffic Hazard*

predict probable dissatisfaction due to noise. (Griffiths and Langdon, 1968).

On HEAVY STREET, noise levels were above sixty-five decibels 45 percent of the time and did not fall below fifty-five decibels more than 10 percent of the time except in the early morning. These noise levels were so high that the traffic noise index read right off the scale. The two-minute sample sound level recording in figure 5 illustrates the uneven character of noise due to the waves of cars that flowed down the street, and to the occasional noisy vehicle which exceeded seventy decibels.

On MODERATE STREET, sound levels were above sixty-five decibels 25 percent of the time. By the traffic noise index, the noise level (6.5) would be rated as "definitely unsatisfactory." On LIGHT STREET, the quietest of the three, sound levels rose above sixty-five decibels only 5 percent of the time, meaning that one-half of the residents would consider the noise level "unsatisfactory" and one-half "satisfactory."

TABLE 2 *Mean Ratings of Traffic Hazard (Low traffic hazard ratings were given to responses indicating feelings of safety and security from traffic and other related incidents. Rating: 1 = very safe, 5 = very unsafe.)*

Question	HEAVY STREET	MODERATE STREET	LIGHT STREET
What is traffic like on this street, how would you describe it? Does it bother you at all?	3.7	3.2	2.2
Is it ever dangerous on your street and around your home? (traffic accidents; incidents, etc.)	3.8	3.0	2.5

The traffic is very dangerous.–Traffic accidents are frequent at both intersections, especially at rush hours.–Traffic is fast, the signals are set fast.–It's dangerous for children because of traffic. You can't wash your car on the street for fear of being knocked down and if water is sprayed on passing cars, they get very angry.–I think it is a highly accident-prone area, I often hear screeching brakes.–This street is murder; I like European streets better. (HEAVY STREET)

It's a busy street, I don't trust the children on the sidewalk.–Hear brakes screeching at corners at night.–It's difficult backing out of the garage because of traffic.–Accidents and near-accidents frequently at (intersection).–Sometimes dangerous with commuter traffic between 5:00-6:00, especially round grocery on corner.–There's something deadly about the street. (MODERATE STREET)

Sidewalks are fine; kids can play, buggies or strollers get round cars very comfortably.–Children have to be taught care in crossing the street.––Traffic is getting worse. (LIGHT STREET)

The two-minute sample sound level recordings on MODERATE STREET show that the noise levels tended to be more variable than on HEAVY STREET but in the same range, whereas the sound level chart on LIGHT STREET shows an ambient noise level much lower than the other two streets.

After the danger of traffic itself, traffic noise, vibrations, fumes, soot, and trash were considered to be the most stressful aspects of the environment on these three streets. (See table 3.) On HEAVY STREET, the noise was so severe that one elderly couple was forced to try to catch up on sleep in the daytime. Many, especially the older people, were unable to be objective about the other characteristics of their street because these stresses totally colored their perceptions of their environment. Adjectives such as "unbearable," or "too much" or "vulnerable" were typical of the responses.

As with traffic hazard, the large mass of vehicles was not always the major problem. It was often the lone individual or the unusual vehicle that disturbed the situation. This was certainly true of HEAVY STREET where the large majority of cars were reasonably quiet and passed by at a smooth even flow. The real offenders were sports cars, buses, and trucks. The steady drone of traffic was certainly bad, but the random deep-throated roar of a bus or large truck, with the accompanying shudder that rattled every window, unnerved the most hardened resident, especially when it continued day and night. The screeching of brakes at the intersections added to the distress.

Residents on HEAVY STREET had petitioned for a sign prohibiting trucks and buses. The sign was installed, but it did not mention buses. It was small, the same color as the background, and was seldom seen. In any case, the law was not enforced, so truck drivers had learned to continue on their way with impunity. Noise problems were not so acute on MODERATE STREET, where people were more bothered by the fumes, dust, and soot which penetrated into their living rooms and bedrooms. LIGHT STREET had a few complaints of occasional noise.

Other Forms of Pollution The condition and cleanliness of the buildings on the three streets was generally high. Maintenance and clean appearance were clearly important to all the inhabitants. HEAVY STREET was constantly on show to outsiders who were traveling through it, and the owners of the buildings were careful to maintain a high standard of cleanliness despite the "disgusting amount of litter." The *appearance* of a quality environment was therefore maintained–and paid for through higher rents–but because the street did not encourage people to be outgoing, tenants were reluctant to accept responsibility for the street itself. Therefore, they avoided picking up trash and were slow to defend the street against vandalism and abuse.

On MODERATE STREET, concerns for trash, dust, and soot, where specifically referred to, were more pronounced than on HEAVY STREET. This street was going through a difficult stage. Traffic and traffic problems were increasing, and there was no clear demarcation between public territory, which was the responsibility of the city, and local territory, which might have been the responsibility of the residents. People in parked cars had been observed dumping the contents of ash trays and beer cans into the gutter. Even so, it was still seen as a "good respectable place to live" and sidewalk maintenance by the local inhabitants helped to keep up the appearance of the street.

LIGHT STREET was very seldom seen by outsiders and so the issue of maintenance was a local matter. This street was also seen to be

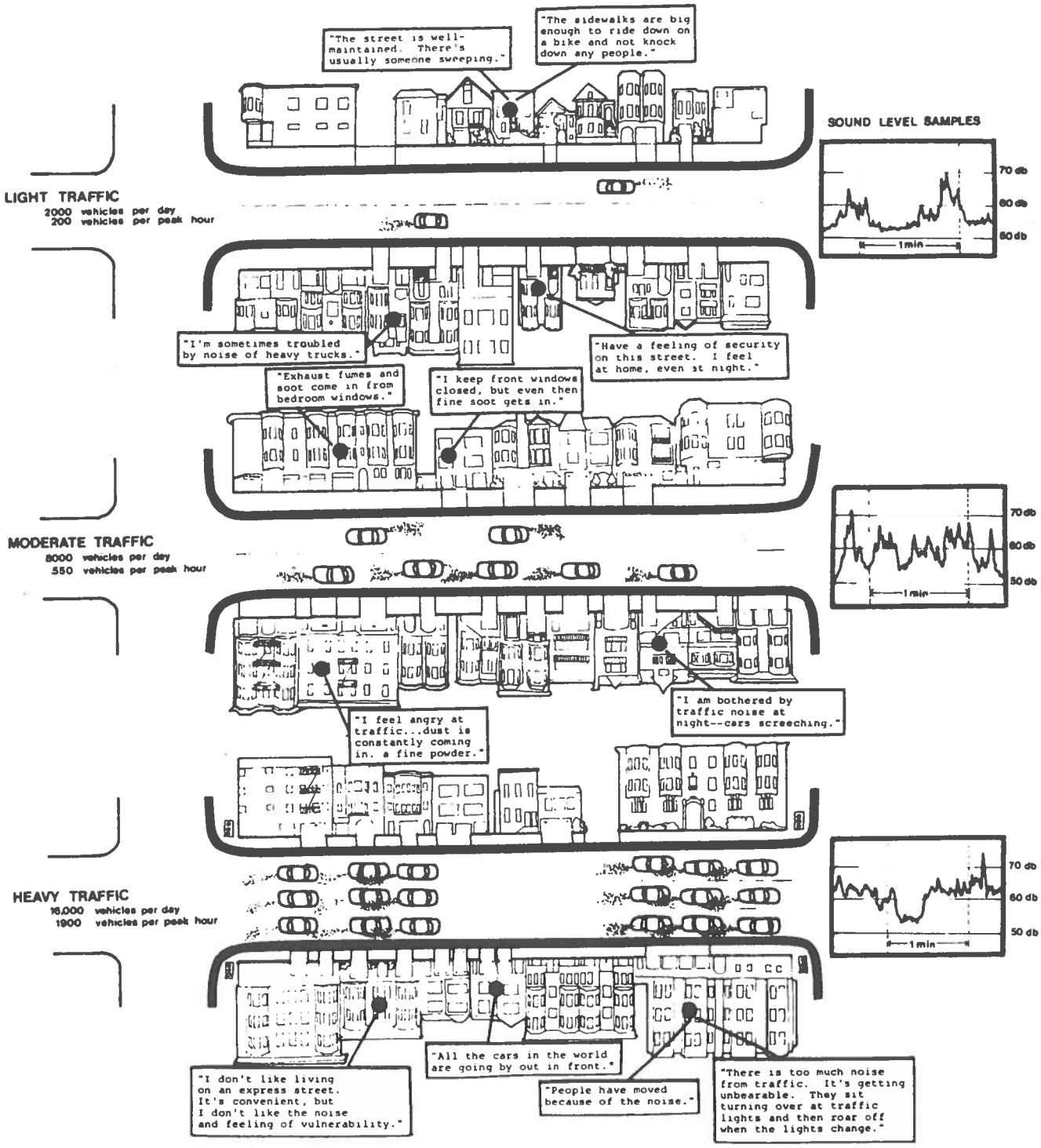

FIGURE 5 *Noise, Stress, and Pollution*

changing and residents had noticed signs of deterioration. As one resident put it, "The quality of [LIGHT STREET] is getting better in that people take great care of their properties, but worse in that there is more traffic and more cars on the street." Indeed, the responses showed that many inhabitants took an interest in looking after the cleanliness of the street, and some had planted their own trees.

The only other inconvenience mentioned was the crowded parking conditions. Many suburban commuters and users of the nearby shopping center were parking on all three streets and taking up parking spaces of the residents. In response to questions concerning the adequacy of street lighting, garbage collection, and street cleaning, respondents considered the three streets to be without serious problems.

In reaction to all these issues, each age group found HEAVY STREET more severe, and the old- and middle-aged groups found MODERATE STREET worse than LIGHT STREET. The only

TABLE 3 *Mean Ratings of Stress, Noise, and Pollution (Low stress, noise, and pollution ratings were given to responses indicating lack of nuisance, adequacy and suitability of street lighting, local services, road and sidewalk width, and good street maintenance. Rating: 1 = low stress, 5 = high stress.)*

Question	HEAVY STREET	MODERATE STREET	LIGHT STREET
Is there anything that bothers you or causes you nuisance on and around this street?	4.5	3.3	2.6
Are you ever troubled by noise and/or vibration?	3.7	2.5	2.4
Are you bothered at all by dirt, pollution, smells, glare? Does it to your knowledge cause any ill health?	3.4	2.9	2.0
Is there adequate street lighting?	1.4	2.0	2.4
Is the street too wide or too narrow?	2.1	1.9	1.7
Are the sidewalks too wide or too narrow?	2.5	1.8	1.3
Do you have adequate local services: garbage collection, street cleaning?	2.2	2.1	2.1
Is your street well maintained, are front yards, planting, sidewalks, etc., well kept up?	1.5	1.8	1.9

Traffic noise bothers me, mostly during the day, but it's heavy at night, also.–I am bothered by the exhaust from traffic and noise. Lately the trucks have been returning to this street, even though they are banned.–Troubled by traffic noise, mostly trucks and motorbikes. The street acts like an echo chamber, especially for sirens. It continues day and night.–Bothered by noise and vibration. I have to straighten pictures frequently.–Noise is terrible from traffic. I can feel vibration even up on the fourth floor, especially from buses.–Have to take a nap during the day as don't get enough sleep at night because of the traffic.–The street is well maintained by old ladies washing down front steps once a week.–Other than traffic, it has a very nice appearance.–It's absolutely disgusting the amount of litter there is.–It's terribly dirty and we often have traffic fumes. I sometimes leave only the rear window open. (HEAVY STREET)

The car gets dirty because it is parked on the street.–Smells from big trucks, not very often.–Bothered by vibration from trucks sometimes, and by noise of hotrodders revving up.–Feel helpless as far as traffic is concerned, I can never finish cleaning.–It's a dirty street, I have to be a janitor and sweep the street. People in cars dump cigar ash and beer cans in the gutter.–It's getting worse because of traffic; getting dirtier. The rot has set in. (MODERATE STREET)

Sometimes bothered by noise of the occasional big truck which will wake the baby.–Motorbikes occasionally make a noise.–At night sounds of hotrodders frequently.–Street well maintained. Usually someone sweeping, my mother or people next door.–A very relaxed family neighborhood, perfect. It makes me very happy.–There are parking conflicts, parking is a pain because outside people put their cars in the driveways. (LIGHT STREET)

exceptions were residents under twenty-five, who were more critical of LIGHT STREET. People on LIGHT STREET tended in many cases to be more aware and more critical of their street, while those on MODERATE STREET were more apathetic.

SOCIAL INTERACTION

Residents were asked a series of questions about the friendliness of the street, the numbers of friends and acquaintances they possessed, and the places where people met. Each respondent was shown a photograph of the buildings on the street and asked to point out where any friends, relatives, or acquaintances lived.

On LIGHT STREET, inhabitants were found to have three times as many friends and twice as many acquaintances on the street itself (9.3 friends and acquaintances per person) as those on HEAVY STREET (4 per person). The diagrammatic network of social contacts in figure 6 shows clearly that contact *across* the street was much less frequent on HEAVY STREET than on LIGHT STREET. The friendliness on LIGHT STREET was no doubt related to the small amount of traffic, but also to the larger number of children on the street and the longer length of residence of the inhabitants. The statements of the inhabitants corroborate this.

On HEAVY STREET, there was very little social interaction. With few if any friends (0.9 per respondent) the residents did not consider it a friendly street. Although it might be argued that this was primarily a consequence of the life style of those living on HEAVY STREET (Keller, 1969), the sense of loneliness came out very clearly, especially in the responses of the elderly. As for MODERATE STREET, residents felt that the old community was on the point of extinction. "It used to be friendly; what was outside has now withdrawn into the buildings. People are preoccupied with their own lives." Some of the families had been there a long time, but the number of longtime residents was diminishing. As other respondents put it, "It is half-way from here to there," "An in-between street with no real sense of community." There was still a core of original Italian residents lamenting that "There are no longer any friends around here." The average number of friends and acquaintances per respondent was only a little higher (total 5.4 per person) than on HEAVY STREET.

There were sharp differences between age groups. The middle-aged residents on the three streets possessed a similar number of friends, although those on LIGHT STREET had more acquaintances. This age group was probably more

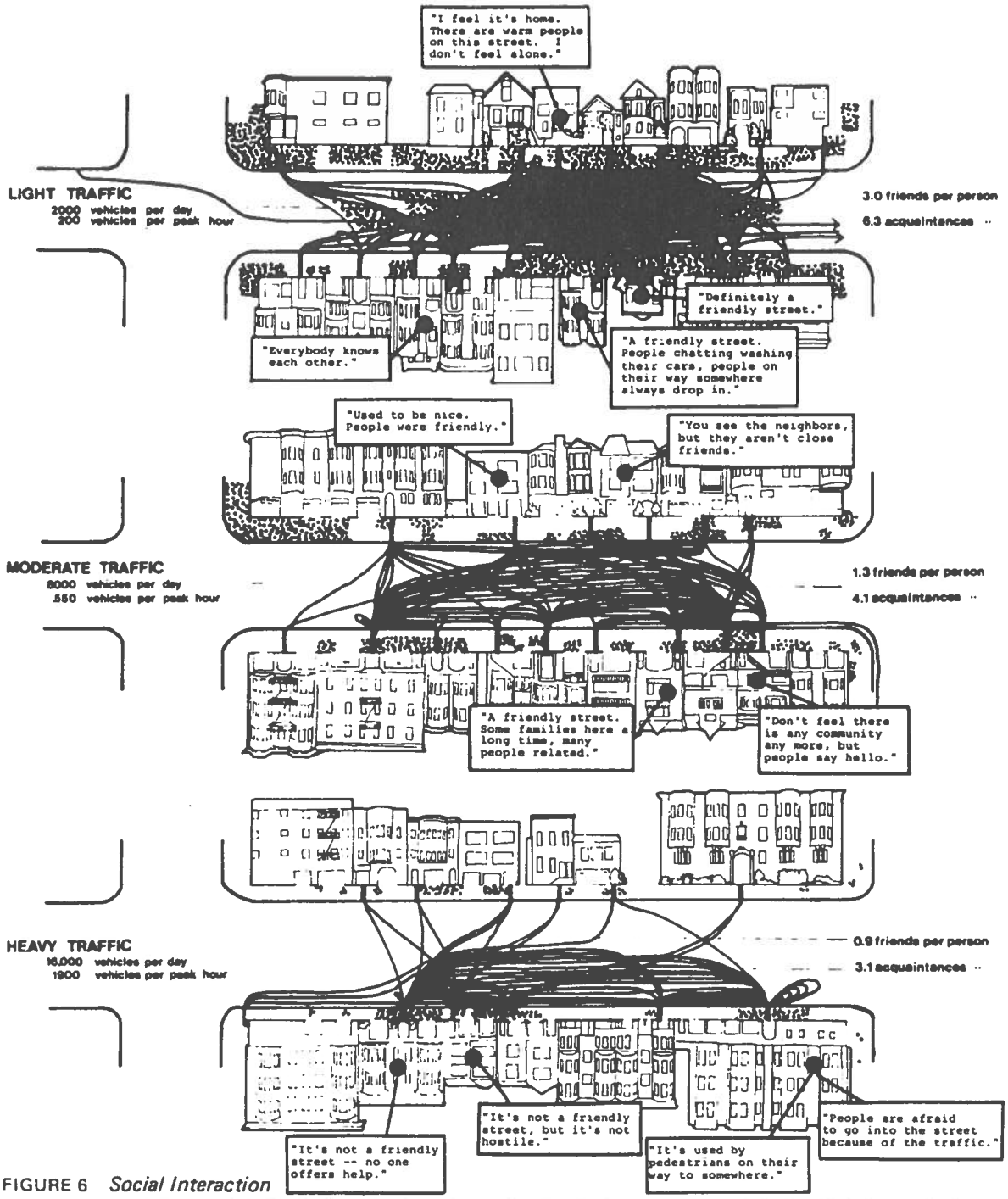

FIGURE 6 *Social Interaction*
Lines show where people said they had friends or acquaintances. Dots show where people are said to gather.

mobile and better equipped to make friends than the other groups. The young and old, on the other hand, who had many less social contacts on HEAVY STREET than on LIGHT STREET, appeared to be more affected by the amount of traffic, especially in establishing casual acquaintanceship with neighbors in the street.

From the notations of street activities drawn by the subjects on the map of the streets (see figure 6), it can be seen that LIGHT STREET had the heaviest use, mostly by teenagers and children. MODERATE STREET had lighter use, more by adults than by children, and HEAVY STREET had little or no use, even by adults. The few reported activities on HEAVY STREET consisted of middle-aged and elderly people walking on the sidewalks but seldom stopping to pass the time of day with a neighbor or friend. Reports on MODERATE STREET indicated that the sidewalks were more heavily used by adults, especially by a group of old men who frequently gathered outside the corner store. Children and some teenagers played on the sidewalks, mostly on the eastern side of the street (probably because most of their homes were on the eastern side and they didn't like to cross the road except at the crossings). On LIGHT STREET,

TABLE 4 *Mean Ratings of Social Interaction (Ratings of high social interaction were given to responses indicating friendliness and community feeling, a wide variety of friends, relatives and acquaintances, and intensive use of the street space. Rating: 1 = high, 5 = low.)*

Question	HEAVY STREET	MODERATE STREET	LIGHT STREET
Do you think this is a friendly street? Do you think there is a feeling of community on this street?	3.2	2.0	2.0
Where do people congregate on the street if at all?	4.4	3.2	1.4
Where do children play if at all?	4.5	3.0	1.7
Where do teenagers gather if at all?	4.7	4.1	3.0
Where do adults casually meet and chat outside if at all?	4.1	2.5	2.7
Do you have any friends and relatives who live on this street?	4.2	3.2	2.8
Which people on this street do you know by sight?	3.5	2.8	1.8

It's getting worse. There are very few children, even less than before.–The only people I have noticed on the street are an older couple in this building who stand outside every night, otherwise there are only people walking on their way somewhere.–Everybody on (HEAVY STREET) is going somewhere else, not in this neighborhood.–Friendly neighbors, we talk over garden fences.–It's not a friendly street as people are afraid to go into the street because of the traffic. (HEAVY STREET)

Friendly street, many people related.–Friendly street, several families have lived here a long time.–There are no longer any of my friends around here any more. Dislike most about street? I don't know neighbors any more. I feel helpless not knowing anyone in case of emergency.–Doesn't feel that there is any community any more. However, many say hello.–There's nobody around. (MODERATE STREET)

Friendly street, people chatting washing cars, people on their way somewhere always drop in.–The corner grocery is the social center. I get a kick to go up there and spend an hour talking.–All family people, very friendly.–Kids used to play in the street all the time, but now with a car every two minutes, they have to go to the park.–Everybody knows each other. (LIGHT STREET)

people used the sidewalks more than any other part of the street, but children and teenagers often played games in the middle of the street. Children also used the sidewalks extensively because of their gentle gradient and their width. Again, a corner store acted as a magnet for middle-aged and elderly people, and a tennis store across the road attracted a small group of young adults. Front porches and steps on LIGHT STREET, and to a certain extent on MODERATE STREET, were used for sitting, chatting with friends, and, by children, for play. The residents of HEAVY STREET regretted their lack of porches.

In conclusion, there was a marked difference in the way these three streets were seen and used, especially by the young and elderly. On the one hand, LIGHT STREET was a lively close-knit community whose residents made full use of their street. The street had been divided into different use zones by the residents. Front steps were used for sitting and chatting, sidewalks by children for playing, and by adults for standing and passing the time of day (especially round the corner store), and the roadway by children and teenagers for playing more active games like football. However, the street was seen as a whole and no part was out of bounds. This full use of the street was paralleled by an acute awareness of the physical environment (as will be described in the section on environmental awareness).

HEAVY STREET, on the other hand, had little or no sidewalk activity and was used solely as a corridor between the sanctuary of individual homes and the outside world. Residents kept very much to themselves so that there was no feeling of community at all, and they failed to notice and remember the detailed physical environment around them. MODERATE STREET again seemed to fall somewhere between the two extremes. It was still quite an active social street, although there was no strong feeling of community. Most activity was confined to the sidewalks, where a finely sensed boundary separated pedestrians from traffic. The ratings in table 4 reflect these differences between the three streets, particularly the perceived lack of meeting places for old people and play places for children on HEAVY STREET, where mean response ratings usually exceeded 4.0.

PRIVACY AND HOME TERRITORY

A number of questions were asked to gauge whether inhabitants felt they had sufficient privacy, and whether they had any feelings of stewardship over their streets.

In their responses, residents of LIGHT and MODERATE STREETS, especially middle-aged residents, evidenced great pride in their homes and streets. (See table 5.) On HEAVY STREET there was little peace and seclusion, even within the home, and residents struggled to retain some feeling of personal identity in their surroundings.

Perception of individual privacy was high throughout this area, perhaps because of the feeling of "privacy and seclusion that exists in any middle class area," as one respondent put it. Inevitably, in a tightknit community like the one that existed on LIGHT STREET, life on the street tended to intrude more into a person's home than it would on a less friendly street, but the residents had achieved a good balance wherein they main-

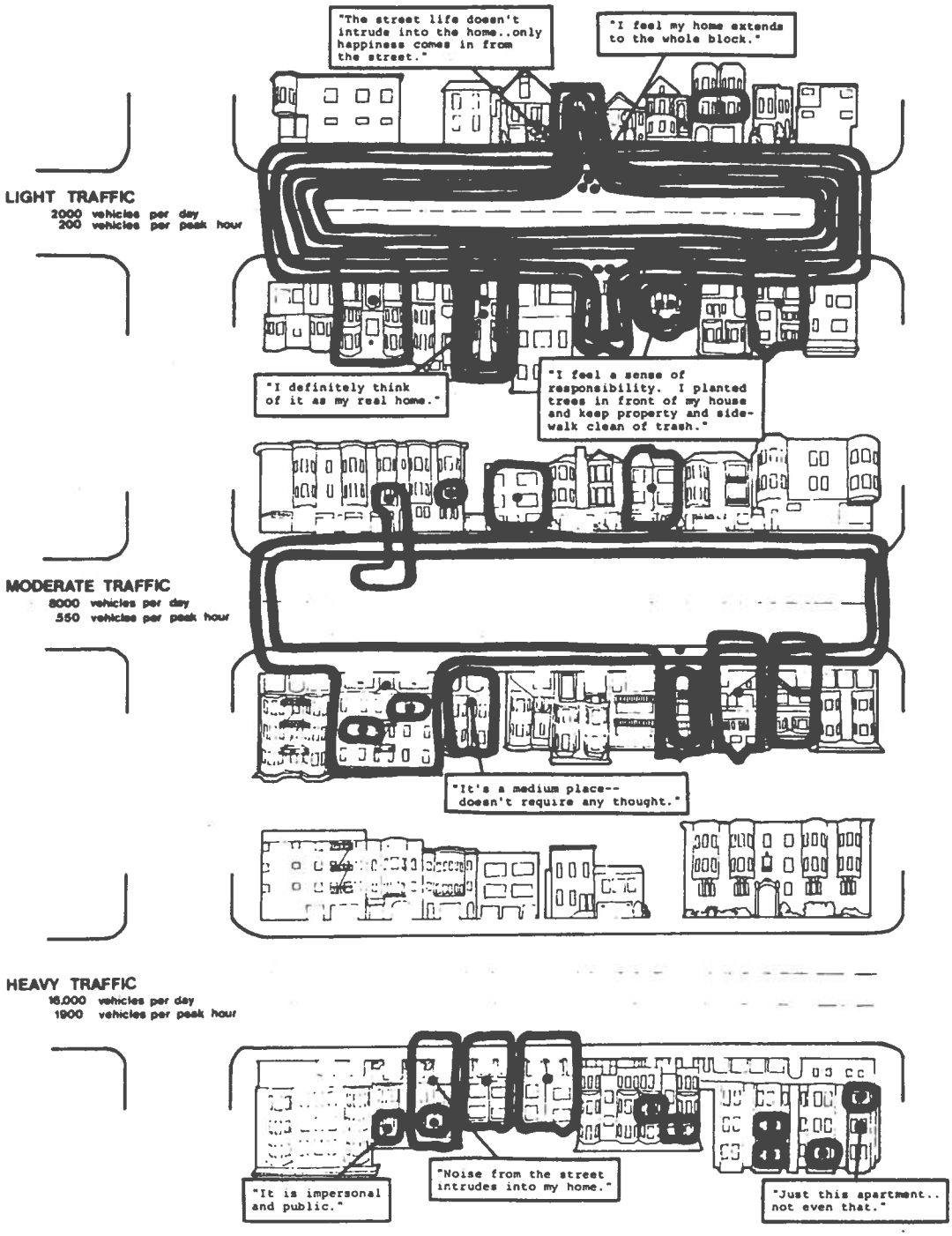

FIGURE 7 *Home Territory*
Lines show areas people indicated as their "home territory."

tained their own household privacy and yet contributed to the sense of community. As one woman enthusiastically put it, "Only happiness enters in." Children and young people often preferred the lack of seclusion because they liked to be part of things. On LIGHT STREET a satisfactory balance had been achieved between a feeling of privacy and contact with the outside world. Even on HEAVY STREET residents occasionally enjoyed the street activity. ("I feel it's alive, busy, and invigorating.") However, for the majority, the constant noise and vibration were a persistent intrusion into the home and ruined any feeling of peace and solitude.

Figure 7 shows the residents' conceptions of personal territory. Even though legally a householder's responsibilities extend to the maintenance of the sidewalk immediately outside his building, residents on MODERATE and LIGHT STREETS considered part or all of the street as their territory. However, the HEAVY STREET resident's sense of personal territory did not extend into the street, and for some, mostly renters in the large apartment blocks, it was confined to their

TABLE 5 *Mean Ratings of Privacy and Home Territory (High ratings of privacy and home territory were given to responses indicating seclusion, lack of intrusion or invasion, extended personal territories, and a sense of belonging and responsibility. Rating: 1 = high; 5 = low.)*

Question	HEAVY STREET	MODERATE STREET	LIGHT STREET
Do you think that your street is relatively secluded?	3.4	2.1	2.4
Do you feel that your street is overcrowded or cramped?	3.3	1.6	2.0
Do you find that street life intrudes into your home at all?	2.9	1.2	1.8
Do you feel that your privacy is invaded by neighbors or from the street in any way while you are in and around your home?	2.5	1.6	2.2
Where do you feel that your "home" extends to; in other words, what do you see as your personal territory or turf?	3.0	2.3	1.2
Do you think of this street as your real home, where you really belong?	2.9	1.9	2.1
Do you feel any sense of responsibility for the way the street looks and for what happens on it?	2.6	2.8	1.3
If an outsider criticized your street would you defend it?	3.0	2.2	1.6

Do you think of this street as your real home where you belong?–Definitely not. It's hard to say where we feel our home is.–Where do you feel your home extends to?–Just this apartment, not even that.–There is a raging war between the residents and those terrible commuters from Marin. The residents want to dynamite patches of the road to slow traffic.–My outdoor space is the roof or the fire escape where I may have plants. (HEAVY STREET)

I am out there with a broom from one end of the block to the other. I am known as the "woman with the broom." (MODERATE STREET)

I tend the sidewalk trees outside the house and the rose bushes in the front.–I like our little street, even though I am not a home owner.–I keep it clean of debris, pick up broken bottles, notify people of anything wrong.–I feel my home extends to the whole block [very emphatic].–I always clean the street, take in dirt off the street, pick up nails, broken glass and paper. At least ten people take care of the street. (LIGHT STREET)

own apartment and no further. This pattern of territorial space corresponds to the pattern of social use of each street. The contrast between the territorial restrictions of those living on HEAVY STREET and the territorial expansiveness of those on LIGHT STREET is one of the more salient findings of the study. The residents on LIGHT STREET are quite similar in this respect to those West End Italians in Boston who considered the boundaries between house and street space to be quite permeable (Fried and Gleicher, 1961). In sum, HEAVY STREET was seen as considerably less private than the other two streets, especially for those most confined to the street, the young and the old.

ENVIRONMENTAL AWARENESS

Street dwellers were each asked to recall all important features of their street, to judge whether their street was in any way different from surrounding streets, and to draw a map of their street.

Figure 8 is a composite of all the maps that each person drew for his own street. The responses to the questions were much richer in content–and more critical in character–on LIGHT STREET than on the other two streets. This can be partly explained by the greater differentiation of frontyards and smaller houses; but it clearly stemmed from an increased awareness of the street environment by the residents themselves.

Interest in the street as evidenced by the maps drawn varied by age group. LIGHT STREET had tremendous appeal for children, who recalled individual buildings, frontyards, steps, particular parked cars, manhole covers, telegraph poles, and even the brickwork setting around the base of a tree. Many of these detailed elements were obviously encountered during their play on the street. On MODERATE STREET, where there was less street activity, the maps of children and young people were accordingly less rich.

Middle-aged people on the other hand seemed to have a more complete impression of their street. Their recollections included combinations of buildings, sidewalks, the roadway, and the traffic itself. For them, LIGHT STREET was seen as a collection of individual buildings with differences in frontyards and porches. MODERATE STREET was much more straight-walled. Residents had accurate memories of driveways, pedestrian crossings, and road markings (possibly because it was seen as a traffic route with finely defined boundaries).

HEAVY STREET was seen overwhelmingly as a continuous traffic corridor, straight-sided without a break for cross streets, and packed with cars. The traffic itself was an easily identified characteristic of the busier street.

As for the responsiveness of the street environment to the needs of the street dwellers, LIGHT STREET once more showed up well. (See table 6.) Two trees had been planted in the sidewalk, other plants were thriving in the occasional frontyard, and flower boxes were prevalent. On HEAVY

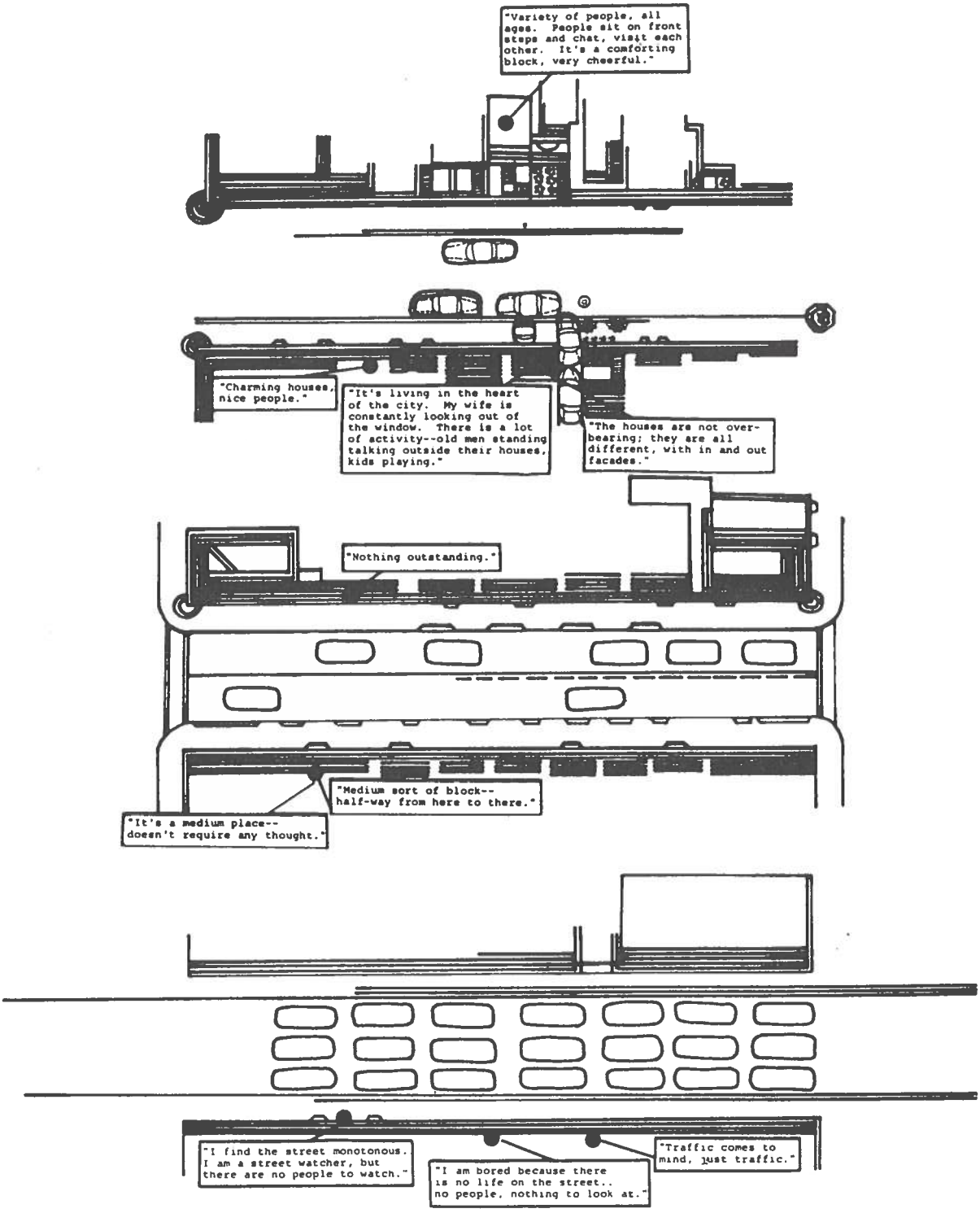

FIGURE 8 *Environmental Awareness*
Composite of maps people drew of their streets. Lines indicate number of times feature was drawn by residents.

STREET, the sidewalks were too narrow to allow anything to grow except the very small bushes that flanked the doors of one or two apartment buildings.

Study Conclusions

1. The intensive traffic conditions on HEAVY STREET led to both stress and withdrawal. Those people who found the traffic conditions intolerable, especially those with children, had moved elsewhere, and the people who lived there at the time of the survey had either withdrawn from the street or had never become engaged in it. They only used it when they had to, they had few local friends and acquaintances, and they had become oblivious to the street as a living environment. If they could, they lived at the backs of their houses. For those who treated HEAVY

TABLE 6 *Mean Ratings of Environmental Awareness (Ratings of high environmental awareness were given to responses that described the street as having a distinct sense of being a particular place and different from other streets, and that were full of rich, varied, and affectionate detail. Rating: 1 = high, 5 = low.)*

Questions	HEAVY STREET	MODERATE STREET	LIGHT STREET
Do you find your street and the life that goes on there interesting? Do you get bored by life on this street, do you find it monotonous?	3.3	2.9	2.3
What parts of the street do you like most? What parts do you find least attractive?	3.1	2.6	2.1
What first comes to mind when you think of your street?	2.3	3.1	2.5
Could you please try to draw a map of what you think of as this street showing all the features of the street and the buildings that stick in your mind no matter how trivial they seem to be.	2.7	2.5	2.1
Do you think this street is different from surrounding streets, is it special or unique in any way?	2.2	3.6	2.1
Do you think there are many different kinds of people on this street? Can you describe them?	3.4	2.1	1.8

I dislike the sterility of the surroundings.–I don't like the fact that there is no greenery.–The first thing that comes to mind are apartment buildings, small apartments, five to six units. This wasn't so until ten years ago when they made the street one-way, before that there was a feeling of neighborhood.–Physically it feels as if you are looking over a void, the street is nonexistent.–The street facade is extremely unmemorable, dull brick or bland plaster. The surfaces are flat and static.–First thing that comes to mind, fast traffic.–It's absolutely dead, not even any night life, nothing. (HEAVY STREET)

Different from other streets in that it has a yellow line down the middle, others don't.–It's all dull, which is what I seek.–First thing that comes to mind, cars especially. (MODERATE STREET)

The houses are not overbearing, they are all different with varigated in-and-out facade.–It's like living in the heart of the city, my wife is constantly looking out of the window. There is a lot of activity–men standing talking outside their houses, the kids playing, etc.–Variety of people, all ages. People sit on front steps and chat, visit other people. It's a comforting block, very cheerful.–I like the set backs, they give individuality. (LIGHT STREET)

STREET as a transient residence, this condition was tolerable. Those who had to treat it as a permanent residence because they were too old or too poor to leave suffered.

In contrast, those who lived on LIGHT STREET were very much engaged with their street. They saw it as their own territory. Their children played on the sidewalk and in the street. They had many friends and acquaintances (over twice as many on the average as those on HEAVY STREET), they noted many more features of the street when they were asked to make a drawing of it, and they were generally much more aware of their street. Despite all this, the rents on HEAVY STREET were higher. Perhaps the apartments on that street, because of their higher exposure and turnover, were more available to a transient population.

The living conditions of those who lived on MODERATE STREET lay somewhere in between the other two, but the residents' levels of satisfaction were lower than their middle position might suggest.

From our results we can state some hypotheses about the apparent effects of traffic on the environmental and social quality of these streets (see figure 9). These hypotheses should be tested in later studies.

a. Heavy traffic activity is associated with more apartment renters and less owner-occupants and families with children. The income levels of the residents are in a similar range.

b. Heavy traffic is associated with much less social interaction and street activity. Conversely, a street with little traffic, and many families, promotes a rich social climate and a strong sense of community.

c. Heavy traffic is associated with a withdrawal from the physical environment. Conversely, residents of the street with low traffic show an acute, critical, and appreciative awareness of and care for the physical environment.

2. There are some exceptions to the above conclusions. Many respondents on MODERATE STREET had chosen that street for its livable environment. MODERATE STREET, however, was changing from a quiet residential street into a major traffic corridor. Therefore, the residents there were often more dissatisfied than those on HEAVY STREET. Their original expectations for the environment were higher and their disappointment was therefore greater.

On LIGHT STREET some respondents perceived the occasional hot-rodder as worse than the traffic on HEAVY STREET for similar reasons. When people expect traffic to be heavy, their behavior adapts to the situation and traffic is tolerated. When they expect it to be light, a hot-rodder is especially intrusive. In conclusion, people were dissatisfied with the streets with lighter traffic when their environmental expectations were not realized either through an environ-

mental decline from a previously higher quality or from deviant traffic behavior.

3. The appearance of environmental quality was found to be quite different from the environmental quality as revealed by the comments of the residents. HEAVY STREET was well maintained and appeared to be of high quality to the outsider (for example, to the city urban design staff in earlier field surveys of the area). The residents were aware of its high status, yet the presence of heavy traffic lowered its quality below that of more modest-looking streets.

4. The pattern of interview responses suggested that the issues of safety, stress, condition, pollution, privacy, and territoriality, followed closely by neighborliness, were of primary concern to the inhabitants of all the streets. Issues such as sense of identity, environmental interest, appropriateness, and individual self-expression were not considered important if the other issues were seen as problems.

5. The general trend was toward increased traffic on each of the three streets, with the prospect that the environment of each street would decline further.

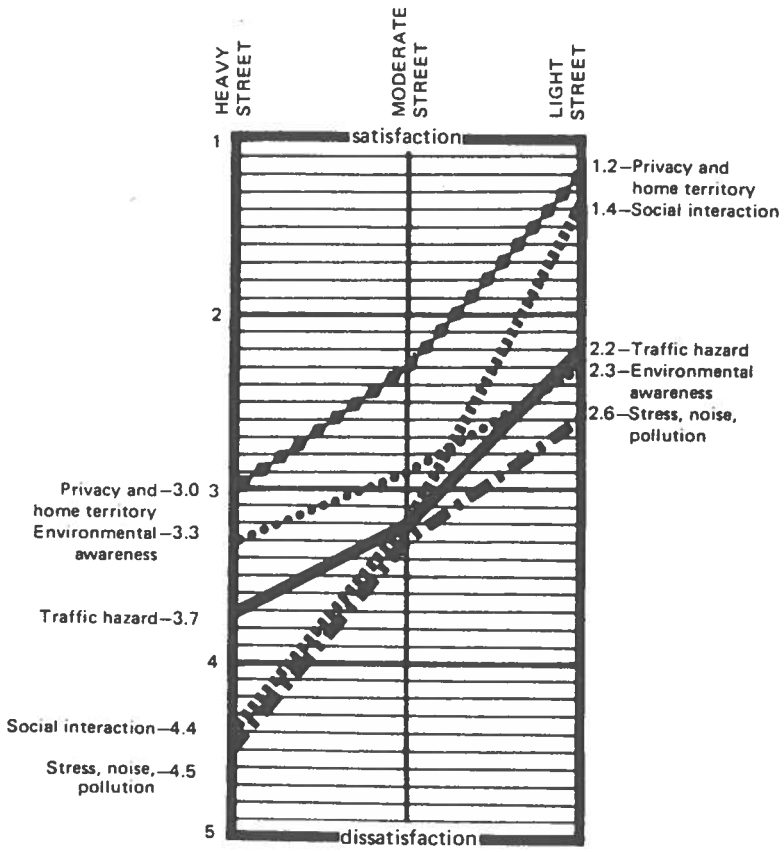

FIGURE 9 *Environmental Quality*

Note: The following interview questions were chosen to represent the "environmental quality" criteria illustrated in this figure.

Traffic hazard: What is traffic like on this street, how would you describe it? Does it bother you at all?

Stress, noise, and pollution: Is there anything that bothers you or causes you nuisance on and around this street?

Social interaction: Where do people congregate on the street, if at all?

Privacy and home territory: Where do you feel that your "home" extends to; in other words what do you see as your personal territory or turf?

Environmental awareness: Do you find your street and the life that goes on there interesting? Do you get bored by life on this street, do you find it monotonous?

Discussion of Conclusions

Objective observations of environmental quality, through traffic flow and noise counts, showed that environmental conditions on HEAVY STREET were particularly severe. Though complaints were numerous, however, they were not so strong as one might reasonably expect. There had been very little public complaint or protest by any group. Why was this?

One major reason appears to be that the erosion of environmental quality had been subtle and slow, taking place over a period of ten years or more. During this time the workings of *environmental selection*, and *environmental adaptation* had been allowed to operate. These are important phenomena to consider in measurements of response to environmental quality.

1. The workings of *environmental selection* may be stated as follows: an environment tends to be selected by those groups who find it most amenable, and to be rejected by those who find it least amenable. Hence when traffic increased on HEAVY STREET, families with children moved away, and single people and couples whose local environmental needs were less but who valued accessibility tended to replace them. The principle does not work perfectly, however. Those who are unable to select their preferred environment through lack of financial, informational, or psychological resources become "locked in" to certain environments, and are therefore likely to suffer the most from changing environmental quality. On HEAVY STREET the older people, finding it too costly and too much effort to move, experienced severe discomforts, and the families who had to remain on MODERATE STREET experienced the loss of friends. Similar predicaments face lower income populations.

People may select a less than ideal environment for reasons other than lack of resources. Many make a *compromise*, sacrificing amenity for the benefits of, for example, an easily available apartment or accessibility to other parts of the city. The apartments on LIGHT STREET had less turnover so they were seldom on the market. Others make

errors of judgment. Visually HEAVY STREET Is a well-maintained high quality street. Therefore, an apartment hunter might be deceived. Another kind of error is the *inability to predict future deterioration.* When many of the present inhabitants moved in to HEAVY and MODERATE STREETS conditions were good. Since then they have worsened.

2. By *environmental adaptation* we mean that those who remain in one environment for a length of time will become adapted (or resigned) to it whether or not it is or has been pleasant, especially if they see no future change in sight. Evidence for this phenomenon can be found in this study, especially in some of the more indifferent responses on HEAVY STREET. (Such evidence can also be found in the research literature in this field [Sonnenfeld, 1966; Wohlwill, 1968].) Those with low expectations or aspirations may be content with any environment.

Besides private adaptation, there appears to be a more publicly oriented defensive kind of adaptation. Most people are stuck with the choices they have made. When an interviewer arrives at the door and asks if there is anything they dislike about their environment, people may not wish to complain even though they may privately acknowledge that their environment is unsatisfactory. They may refuse to complain in order to keep up their social image and the sales value of their property, or through reluctance to admit that they have limited resources or have made an error of judgment.

Individual and family adjustments to a deteriorating environment were further muted because there was no clear public target for resentment, only the individual automobiles and trucks. No particular agency was threatening the environment or initiating changes. This worked both ways; residents' hopes were not raised that anything would be done about their problem, but neither were their frustrations focused sufficiently for them to band together in protest.

Despite the private nature of the adjustments and the slowness of the deterioration, a majority of the inhabitants were still well aware of their plight, as their comments tell.

One final and more positive finding of this study was what it told us of life on a "good" residential street, namely LIGHT STREET. Since we cannot hope to improve urban environments without some positive goals to work toward, LIGHT STREET performs a critical function.

Environmental Proposals

1. Policy usually has to be made without the benefit of adequate research, and this study is no exception. The strongest proposal resulting from the study was the designation in the adopted Urban Design Plan (San Francisco City Planning Department, 1971) of "protected residential areas" throughout San Francisco (figure 10). These are areas which will be protected from through traffic by policies such as the improvement of public transit; the concentration of traffic on the city's main arteries by increasing their capacity through separated grades, selective widening, parking controls, and so on; and the blocking of through traffic by devices such as rough pavement surfaces, "necking down" entrances, bending alignments, landscaping, lighting and sidewalk treatment, all of which would slow traffic down to a residential pace (and incidentally provide more street recreation space).

2. On streets where traffic flows and speeds could not be reduced, ways of ameliorating conditions were proposed. These included sidewalk protection by means of trees, low walls, hedges, and so on; the provision of alternative play spaces to divert children's activities away from the dangerous street; the protection of residences from glaring street lights, car lamps, and the view of passing vehicles through the planting of trees; the clear definition of parking spaces; and the encouragement of inhabitants to exercise some interest in their own frontyards and sidewalks through provisions and subsidies for private planting, benches, and the like.

Environmental Standards

Environmental conditions on residential streets will not be improved unless means of determining acceptable and unacceptable conditions are available. Present planning thought is running against the formulation of standards, as planners have come to realize the variability of population needs and situations and the difficulties of scaling environmental conditions. Yet without standards or specific guidelines, planning controls will remain amorphous and ineffectual. There is an urgent need at the very least to articulate unacceptable environmental conditions for particular groups. These conditions might be couched in the form of environmental performance standards.

The field of noise abatement, which has progressed quite far in trying to set environmental standards related to behavioral response, has encountered some difficulties. Simple decibel ratings (for example, forty-five decibels as a tolerable level inside residences) have to be modified by the "duration, frequency, substantive content of the sound and individual differences" (U.S., Depart-

ment of Housing and Urban Development, 1969). The Traffic Noise Index (Griffiths and Langdon, 1968), developed in Britain, attempts to take a few of these factors into account. The Buchanan Report (Her Majesty's Stationary Office, 1964) identified "vulnerable" populations. But what about standards which will allow people to feel comfortable on sidewalks, or to cross the street, which encourage neighborliness, allow privacy and an ample sense of personal territory, or which promote care and interest for the physical environment of the street? These are even more difficult measures to scale. The effort to measure pedestrian crossing delay times as an indicator of residential quality, which was used in the *Kensington Environmental Management Study* (Greater London Council, 1966), was an interesting attempt in this direction. The work reported here is not substantial enough to develop such indicators, but this is the direction of our research.[5]

Research Implications

The results of this study are suggestive but obviously unrepresentative. Our a priori groupings of

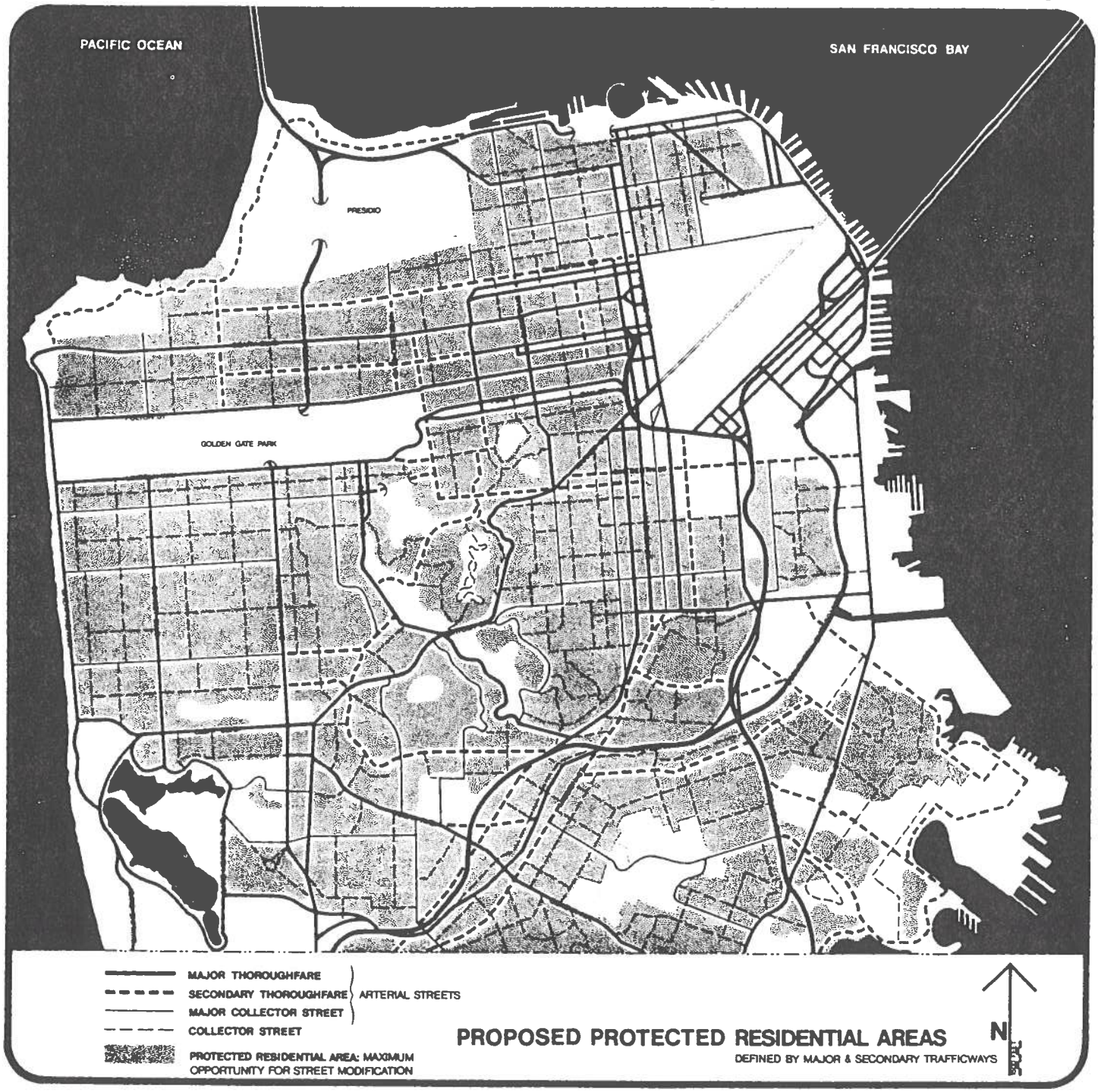

FIGURE 10

issues under criteria headings proved a useful way of organizing the interviews and observations. More studies examining larger numbers of street conditions and types of population are clearly required. Such studies should use more structured questionnaires that would allow subjects to make their own ratings and selections from adjective and other check lists (Craik, 1967; Shaffer, 1967). They should also use a more comprehensive set of observable environmental indicators (such as pedestrian delay times, counts of street activity, closed windows, drawn blinds, parked cars, trash, flower boxes, and other signs of personal care) and a finer assessment of traffic variables (including flows at different times of day and night, speed levels, traffic composition, traffic control signals, and so on).

Multivariate analyses of interviews, traffic composition, and environmental indicators would then allow us to understand the ways in which factors tend to cluster, and to develop predictive models from regression analyses of response to various conditions. With such models, indices (similar to the traffic noise index) could be established to predict subjective responses to environmental phenomena such as levels of privacy, neighborliness, street identity, stress, and sense of safety for residential streets. The ability to predict the flow and speed of traffic from environmental conditions, given the desire lines operating in an area, would allow the control of speeds and flows at environmentally acceptable levels. We know that signs alone do not control speed. What are the effects of rough surfaces, trees, "necking down" streets, and street bends on these traffic variables?

Finally, more extensive surveys to assess the numbers of people who actually live under the deteriorated environmental conditions of streets with heavy traffic are needed. In a recent book, J. M. Thompson (1970) calculated that one million people in London would be living within 200 yards of the proposed motorway system. The implication was that one million people would be suffering from a deteriorated environment. Such accounts of conditions in a U.S. metropolitan area might have a significant impact on the allocation of investment to environmental improvements.

Authors' Note: *We are indebted to the San Francisco Department of City Planning (Director, Allan Jacobs) for supporting this project through an urban planning grant from the U.S. Department of Housing and Urban Development, under the provisions of Sec. 701 of the Housing Act of 1954, as part of their Urban Design Study, and for permission to use the drawings. Elizabeth Seltzer assisted with the drawings and Hugo Blasdell carried out the noise surveys and analysis.*

NOTES

[1] Estimated from Report no. 4, San Francisco City Planning Department (1969–70).

[2] For example, the Barnsbury Environmental Study (Great Britain, Ministry of Housing and Local Government, 1968) and the Pimlico Precinct Study (City of Westminster, 1968).

[3] All traffic statistics were obtained from the San Francisco Department of Public Works, Traffic Engineering Section.

[4] The traffic noise index is a function of the 50 percent noise level and the difference between the 10 percent and 90 percent levels.

$$TNI = L_{50} + 4(L_{10} - L_{90}) - 30$$

This figure has been shown to correlate with expressions of annoyance. Our budget did not allow us to take the customary hourly samplings over the full twenty-four-hour period.

[5] A study of a larger residential area in Oakland, California, is now under way supported by small grants from the U.S. Department of Transportation and the National Institute of Mental Health.

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