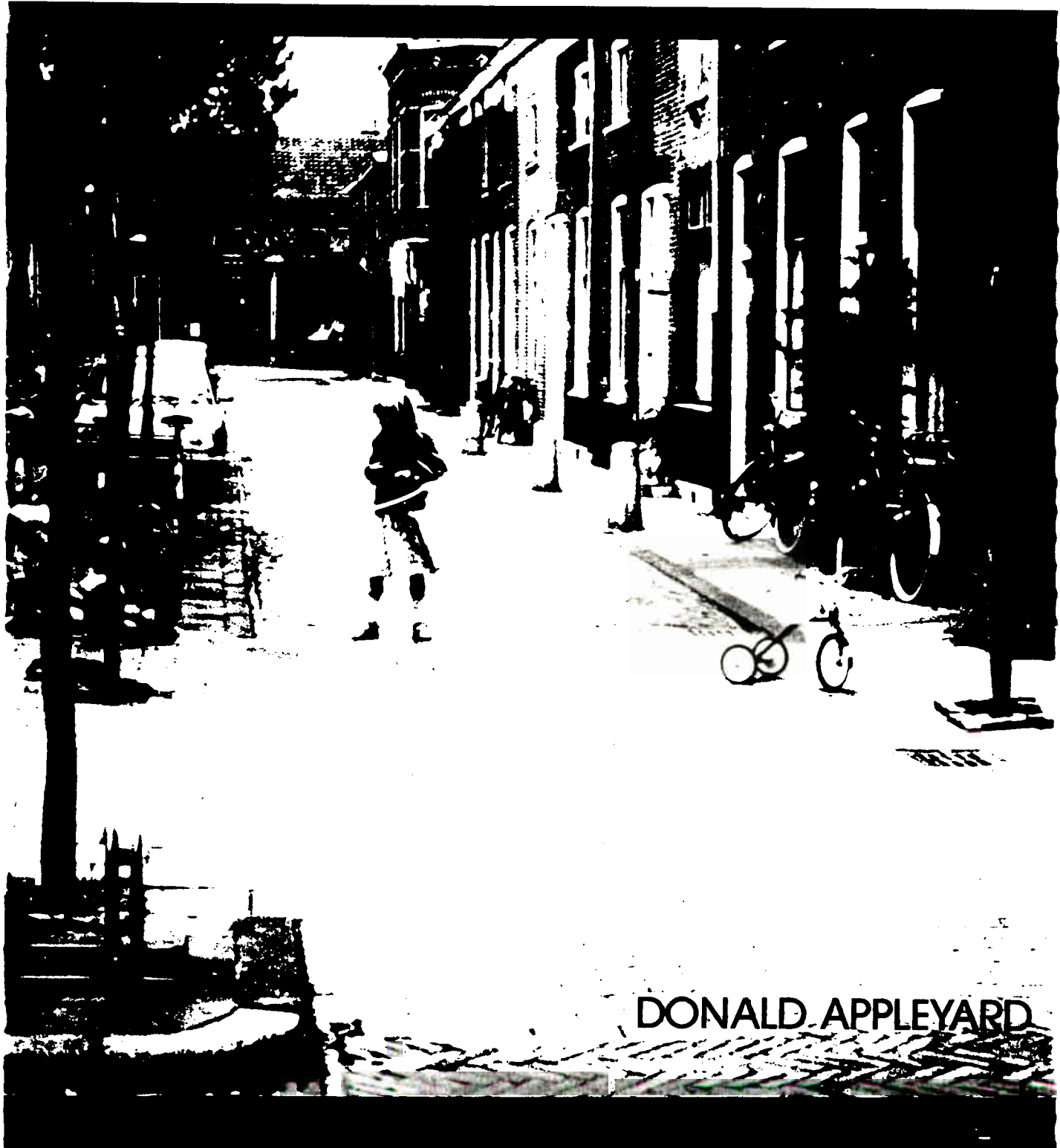# LIVABLE STREETS

DONALD APPLEYARD

1 Three Streets in San Francisco

In the fall of 1968, the City Planning Department of San Francisco embarked on an Urban Design Plan. The first year of the two-year study was directed to an analysis of San Francisco's environment, by means of surveys and interviews. The Urban Design Group began with a field survey of every street block in the city. Two observers drove down every block, rating each on a 1 to 5 scale for its various visible qualities: the amount of vegetation, the quality of view, the degree of maintenance, the variety of façade, and the distinctness from other street blocks. The distance of each block from open space was also calculated. Originally, it was also intended to assess traffic nuisance and climate conditions, but these qualities proved too ephemeral to measure on a windshield survey, so they were omitted.

At the same time, an attitudinal survey was made to explore the environmental values held by different populations in the city. The surveys provided some interesting insights about each street, but the most useful results were the overall ratings of environmental concern. Traffic "safety at intersections" was held to be the most widespread environmental problem, followed closely by "maintenance" and "lack of open space." A housing survey taken in the same year also confirmed that traffic was viewed as a major nuisance in the city. The research group's emphasis on the visual quality of the city streets shifted toward a broader concern for their livability, and we decided to carry out an in-depth study of the effects of traffic on just a few street blocks (Appleyard, 1970).

Three streets—Franklin, Gough, and Octavia—were selected because they were identical in appearance, yet quite different in their volumes of traffic. They were labeled HEAVY, MEDIUM, and LIGHT TRAFFIC streets on account of their average daily traffic flows of 15,750, 8,700, and 2,000 vehicles. HEAVY street was one-way with synchronized stop lights that encouraged speeds of up to 45 m.p.h. The other streets were two-way. HEAVY and MEDIUM streets had been connected, two miles to the south, to a freeway and thus received a considerable amount of through traffic. The three study blocks were part of a residual Italian neighborhood with the simultaneous presence of other white Americans and a small but growing Oriental minority. By social class and income, the streets were relatively homogeneous. Contrasts, however, occurred in family composition, ownership, and length of residence.

LIGHT street was predominantly a family street with many children. Grown-up children were even returning to bring up their own children there. One-half of the people interviewed were homeowners,

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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 with many old people, especially elderly single women. 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 $140.00 among our respondents, whereas those on LIGHT street averaged $103.00 per month. The MEDIUM street population stood in between; average length of residence here was 9.2 years and average rents were $120.00.

The three streets were typical of San Francisco with light-colored wooden, stucco, or brick-finished terraced houses and apartments built up to the building-line, very few front yards, and very few gaps between the houses. The architectural style ranged from Victorian to modern. They were pleasant-looking blocks. The streets were each fairly level, with a slight gradient to the south before they ran up a steep hill. They were close to shopping and community facilities.

Study Design

The study drew on two sources of information. First, a one-hour interview was taken with twelve residents on each block, from three equal age categories, the young (under 25), the middle-aged (25-55), and the elderly (over 55). This small sample represented about 30 percent of the households on each block. Second, observations were made of pedestrian and traffic activity on the streets.

The interview design stemmed from some earlier thinking on transportation impacts (Appleyard and Lynch, 1967; Appleyard and Okamoto, 1968). Five sets of issues were explored in the interview: traffic hazard; stress, including noise and air pollution; neighboring and visiting; privacy and sense of territory; and environmental awareness. The interview was introduced as a survey of what it was like to live on the street, as a means of finding out what each resident thought of his street and of seeking any suggestions he might have for its improvement. Residents were not told that we were primarily interested in the effects of traffic.

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. (MEDIUM 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)

Traffic Hazard   Traffic danger was a matter of concern on all three streets, especially on HEAVY street (1). Excessive speeds were frequently mentioned as being dangerous, not only for children, but for washing cars, or backing cars out of garages. Most of the safety problems were experienced indirectly through seeing large numbers of cars speeding down the hill, or through hearing the screech of brakes. Several residents wanted the speeds 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 hot-rodder who was, in some instances, a greater menace than the steady stream of traffic on HEAVY street. He appeared without warning, often jumping stop signs, and was extremely dangerous for children playing in the street. On LIGHT street, delivery trucks often parked so as to block the view for motorists approaching the intersection.

All age groups considered LIGHT as safe, MEDIUM as neither safe nor unsafe, and HEAVY as unsafe.

Noise, Stress, and Pollution   After the danger of traffic itself, noise, vibrations, fumes, soot, and trash were the most stressful aspects of the environment on these three streets (2). Response ratings to the first
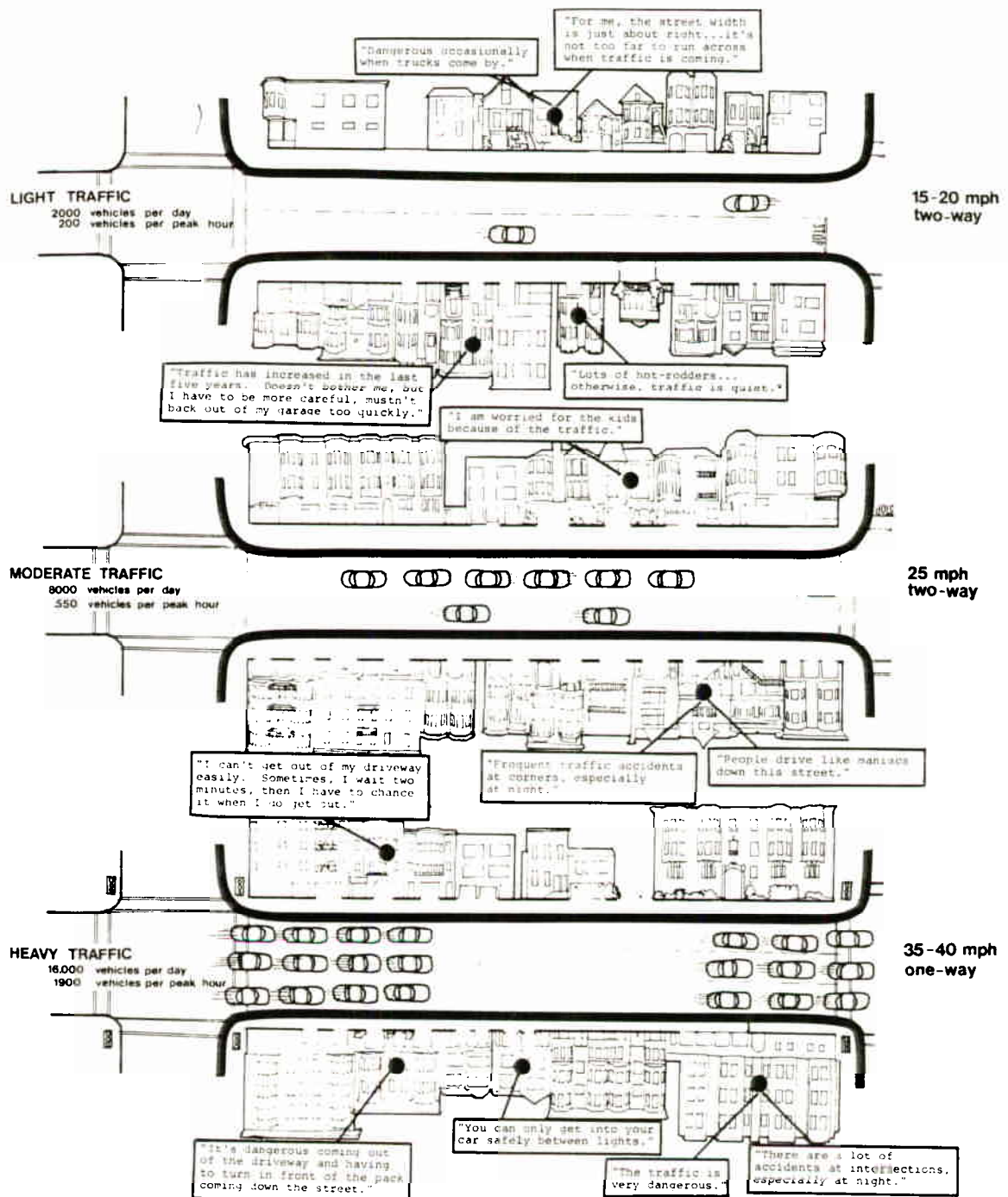
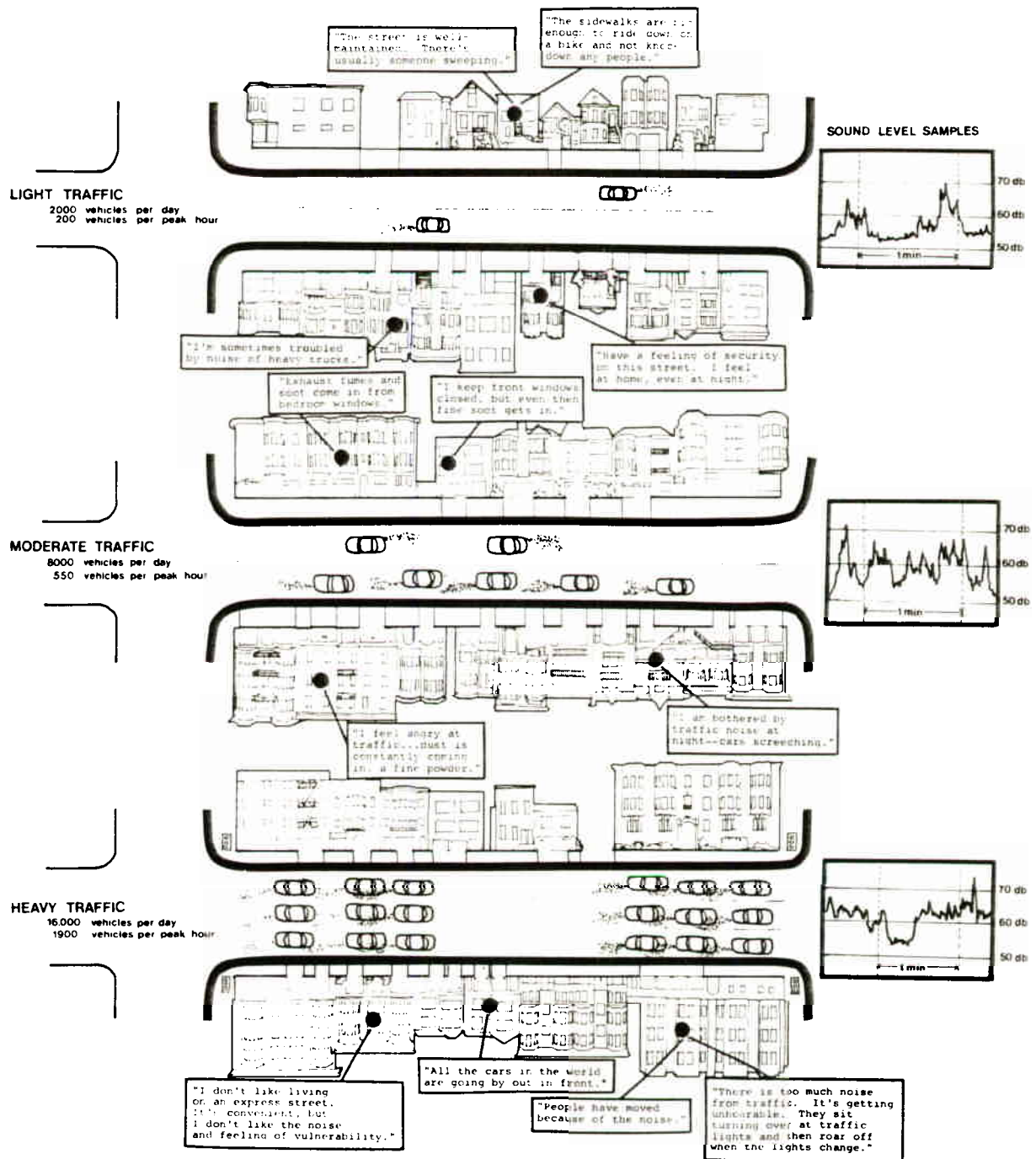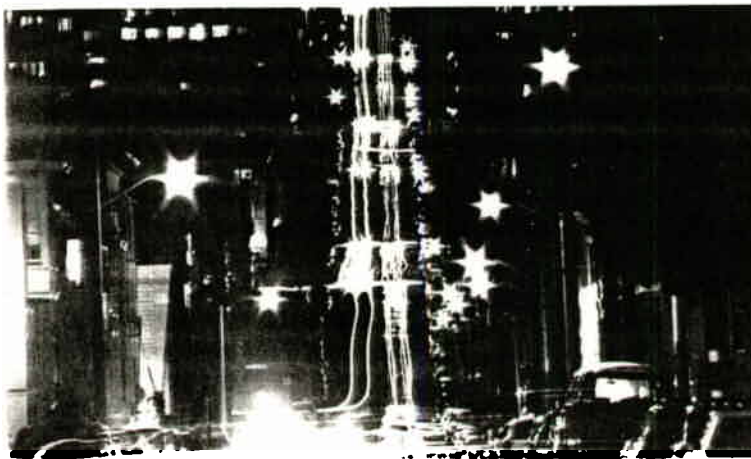FIGURE 1.
San Francisco. Traffic hazard on three streets

FIGURE 2.
San Francisco. Noise, stress, and pollution on three streets

Night-time views of three streets. Ted Barnes

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)

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. —Even with the windows closed, the dirt gets in. —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. (MEDIUM Street)

Troubled by traffic noise, mostly trucks and motorbikes. The street acts like an echo chamber, especially for sirens. It continues day and night. —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. —It's so noisy it just ruins the reason you're walking. You want to look at a tree and somehow you can't. —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. —There's such a layer of grit on the plants and the walkways, that we have to hose them twice a week. I don't know how the plants have been able to survive. (HEAVY Street)

general question in this category were strongly negative on HEAVY street and negative on MEDIUM street.

As with traffic hazard, the large mass of vehicles was not always the major problem. Often the individual or minority vehicles disturbed the situation. This was certainly true of HEAVY street, where most cars were reasonably quiet and flowed evenly. The real offenders were sports cars, Volkswagens, buses, and trucks. Screeching brakes added to the stress.

Residents on HEAVY street petitioned for a sign prohibiting trucks and buses. A sign was installed by the city, but it did not forbid buses: and because it was small and blended into the background, it was not seen or enforced. Noise problems were not so acute on MEDIUM street, where people were bothered more by fumes, dust, and soot. LIGHT street had a few complaints of occasional noise.

Measurements of noise levels were made on all three streets at four periods during a weekday: early morning (6:30–8:30 A.M.), late morning (11:00 A.M.–12:30 P.M.), late afternoon (5:00–6:00 P.M.), and early evening (7:00–8:00 P.M.). In each measurement period, 50 consecutive measurements were made at 15-second intervals at corner and mid-block locations on each street.

On HEAVY street, noise levels were above 65 decibels for 45 percent of the time and did not fall below 55 decibels more than 10 percent of the time except in the early morning. These noise levels were so high that the Traffic Noise Index, a composite measure of traffic noise (Griffiths and Langdon, 1968), read right off the scale.

On MEDIUM street, sound levels were above 65 decibels for 25 percent of the time. On LIGHT street, the quietest of the three, sound levels rose above 65 decibels only 5 percent of the time.

Trash and Litter The condition and cleanliness of the buildings on the three streets were generally good. 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."

On MEDIUM street, concerns for trash, dust, and soot were more pronounced than on HEAVY street. This street was going through a difficult stage. Traffic and traffic problems were increasing, and yet there was no clear demarcation between public territory that was the responsibility of the city, and local territory that might have been the responsibility of the residents.

LIGHT street was very seldom seen by outsiders and so the issue of maintenance was a local matter, but the street was also seen to be 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." Many inhabitants took an interest in looking after the cleanliness of the street, and some had planted their own trees.

Neighboring and Visiting A series of questions asked inhabitants about the friendliness of the street, the number 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, and acquaintances lived (3).

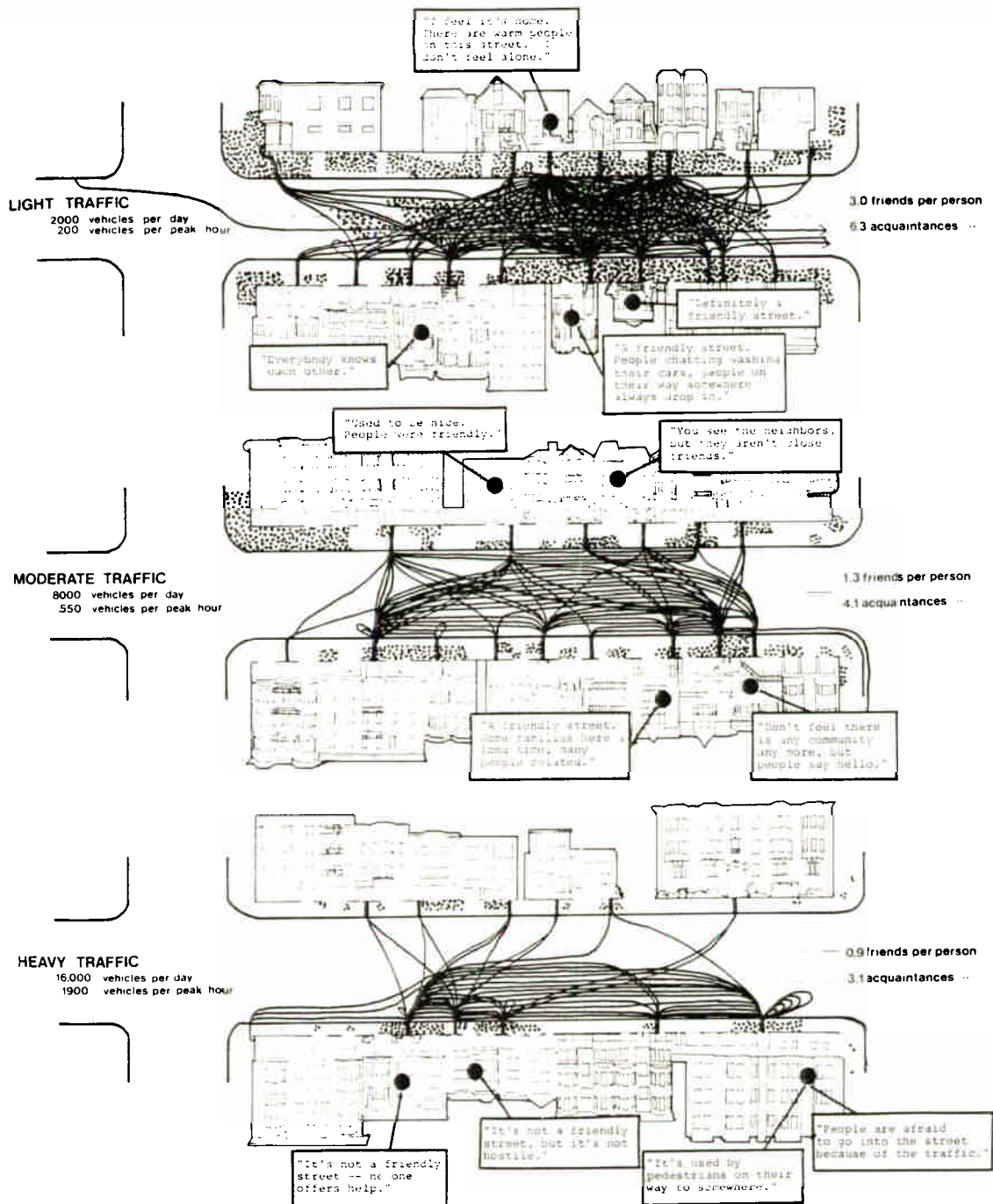On LIGHT street, inhabitants were found to have three times as

FIGURE 3.
San Francisco. Neighboring and visiting on three streets: lines show where people said they had friends or acquaintances. Dots show where people are said to gather

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. (MEDIUM 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)

many local friends and twice as many acquaintances as those on HEAVY street. The diagrammatic network of social contacts shows clearly that contact across the street was much rarer on HEAVY street than on LIGHT street. The friendliness of LIGHT street ("definitely a friendly street") no doubt related to the small amount of traffic, but also perhaps to the larger number of children on the street and the longer length of residence of the inhabitants.

On HEAVY street, there was very little social interaction. Residents had few if any friends there (0.9 per respondent). Although it might be argued that this was primarily a consequence of the life style of those living on HEAVY street, the sense of loneliness came out very clearly, especially in the responses of the elderly. "It's not a friendly street— no one offers help. People are afraid to go out into the street because of the traffic."

As for MEDIUM street, there was a feeling 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 these were diminishing in number. As other respondents put it, "it is a 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." But the average number of friends and acquaintances per respondent was only a little higher than on HEAVY street.

There were sharp differences between age groups. The middle-aged group on the three streets possessed a similar number of friends, although those on LIGHT street had more acquaintances; they were probably more mobile and better equipped to make friends than the other groups. The young and old age groups, on the other hand, who had far fewer social contacts on HEAVY street than on LIGHT street, appeared to be more affected by the amount of traffic.

From the notations of street activities drawn by the subjects on the map of the streets (3), it can be seen that LIGHT street had the heaviest use, mostly by teenagers and children. And yet, "children used to play on the street, but now with a car every two minutes they go to the park." MEDIUM street had lighter use, more by adults than by children, and HEAVY had little or no use, even by adults. The few reported activities on HEAVY street consisted of middle-aged and elderly people using the sidewalks, though they seldom stopped to pass the time of day with a neighbor or friend. On MEDIUM street the sidewalks were more heavily used by adults, especially a group of old men who frequently gathered outside the corner store. Children and some teenagers played more on the eastern sidewalk. On 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 sidewalk extensively because of its gentle gradient and 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 MEDIUM street, were used for sitting on, chatting with friends, and by children for play. 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 the elderly. LIGHT street was a closely knit community whose residents made full use of their street. The street had been divided into different
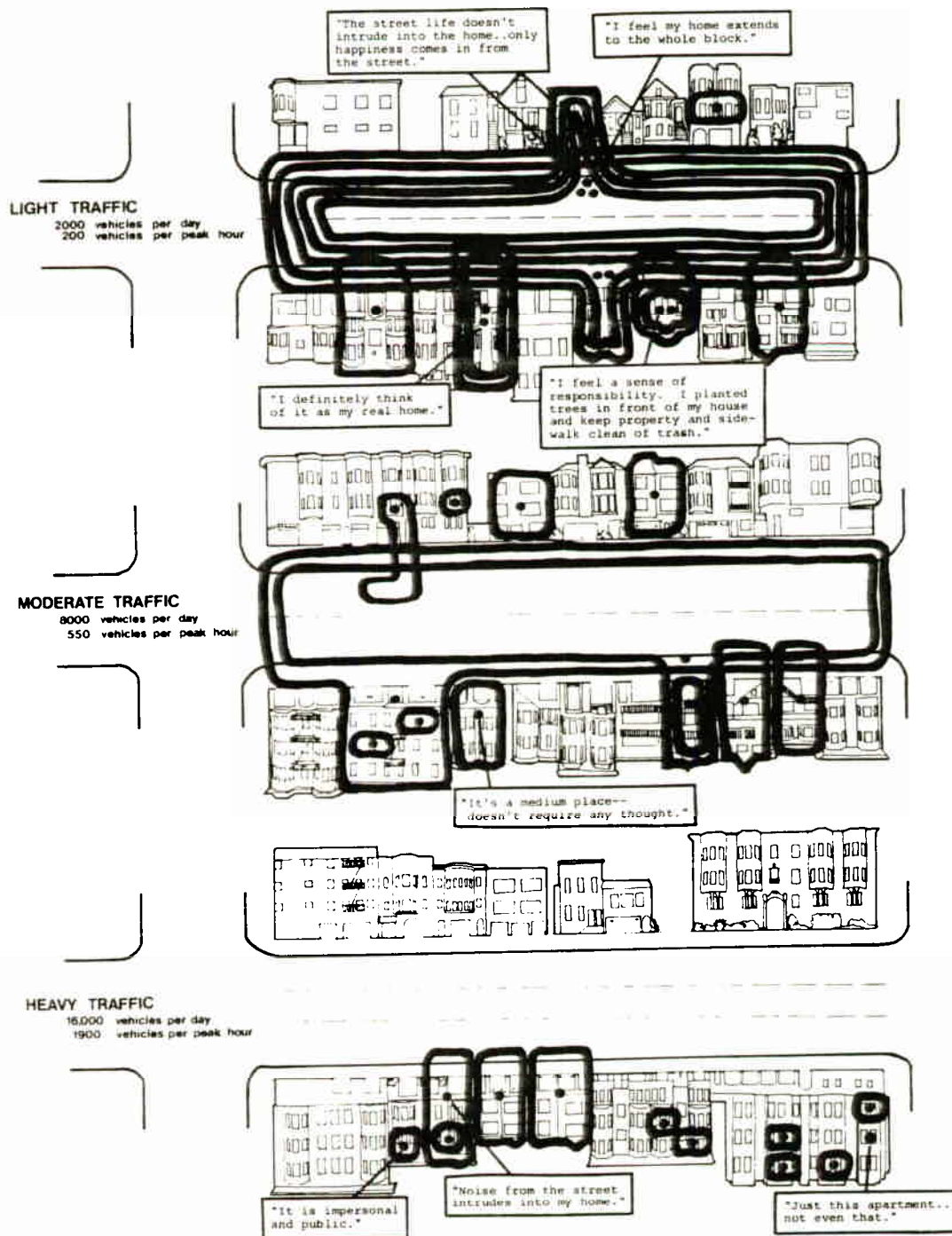
FIGURE 4.
San Francisco. Home Territory on three streets: lines show areas people indicated as their "home territory"

use zones by the residents. Front steps were used for sitting and chatting. sidewalks for children playing. and for adults to stand and pass the time of day. especially around the corner store. and the roadway by children and teenagers for more active games like football. However. the street was seen as a whole and no part was out of bounds. 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. There was no feeling of community at all. MEDIUM 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 and most activity was confined to the sidewalks where a finely sensed boundary separated pedestrians from traffic.

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.

General reactions to LIGHT and MEDIUM streets were very favorable. especially among middle-aged residents. Great pride in their home and street was evident in their remarks. 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. It had. as one respondent put it. the feeling of "privacy and seclusion that exists in any middle-class area." Inevitably. in a tight-knit community. like that 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. They maintained 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. as they liked to be part of things. 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 4 shows the residents' conception of personal territory. Even though legally a householder's responsibilities extend to the maintenance of the sidewalk immediately outside his building. residents on MEDIUM and LIGHT streets considered part or all of the street as their territory. However, the HEAVY street residents' sense of personal territory did not extend into the street. and for some, mostly renters in the large apartment blocks. it was strictly confined to their own apartments. This pattern of territorial space corresponds to the pattern of social use. The contrast between the territorial restrictions of those living on HEAVY street and the territorial expansiveness of those on LIGHT street was one of the more salient findings of the study. In this respect. the residents on LIGHT street acted similarly to those West End Italians in Boston who considered the boundaries between house and street space to be quite permeable (Fried and Gleicher, 1961).

Street Images: Environmental Awareness   Residents of each block were asked to recall all important features of their streets, to judge whether their street was in any way different from surrounding

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." (MEDIUM 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)

"Variety of people, all
ages. People sit on front
steps and chat, visit each
other. It's a comforting
block, very cheerful."

"Charming houses,
nice people."

"It's living in the heart
of the city. My wife is
constantly looking out of
the window. There is a lot
of activity--old men standing
talking outside their houses,
kids playing."

"The houses are not over-
bearing; they are all
different, with in and out
facades."

"Nothing outstanding."

"Medium sort of block--
half-way from here to there."

"It's a medium place--
doesn't require any thought."

"I find the street monotonous.
I am a street watcher, but
there are no people to watch."

"I am bored because there
is no life on the street...
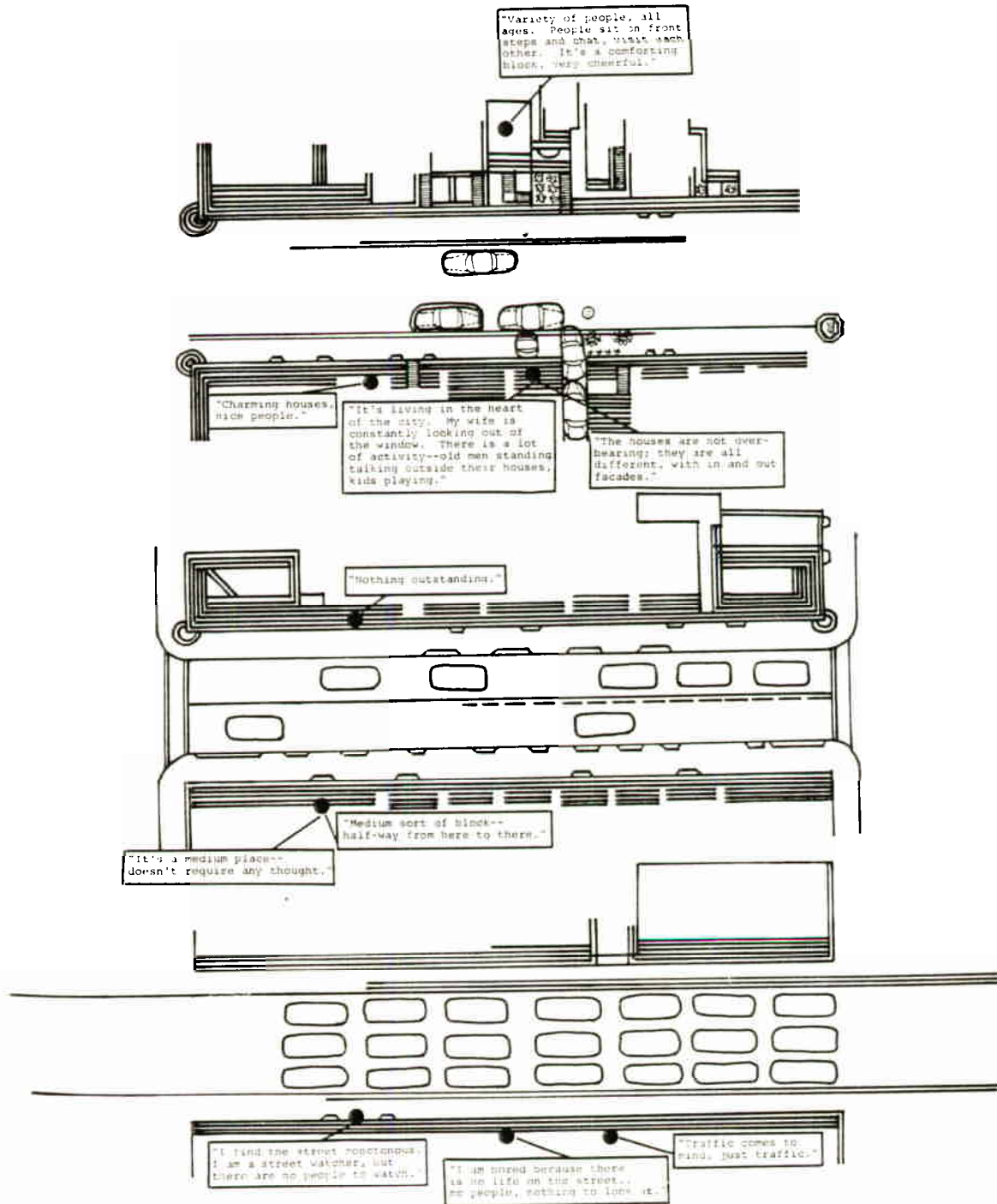no people, nothing to look at."

"Traffic comes to
mind, just traffic."

FIGURE 5.
San Francisco. Environmental awareness: composite of maps people drew of their streets. Lines indicate number
of times feature was drawn by residents

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. (MEDIUM Street)

The houses are not overbearing, they are all different with variegated 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. (LIGHT Street)

streets, and to draw a map of their street. Figure 5 is a composite of all the maps that each person drew for his or her 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 front yards and smaller houses, but clearly it 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, front yards, steps, particular parked cars, manhole covers, telegraph poles, and even the brickwork setting around the base of a tree. Many of these elements were obviously encountered during their play on the street. On MEDIUM 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 a combination of buildings, the roadway, and the traffic itself. For them, LIGHT street was seen as a collection of individual buildings with detailed differences in front yards and porches. MEDIUM street was much more straight-walled; residents had accurate memories of driveways, pedestrian crossings, and road markings (possibly because the street 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. Two trees had been planted in the sidewalk, other plants were thriving in the occasional front yard, and flower boxes were prevalent. On HEAVY street, the sidewalks were too narrow to allow anything except the very small bushes that flanked the doors of one or two apartment buildings.

Some Questions Raised

What did this small pilot study tell us? First, it confirmed some expectations. Heavy traffic did indeed create a whole range of problems for residents: it was dangerous, noisy, and its effects on neighboring and sense of possession of the street were apparently devastating. People had withdrawn altogether from HEAVY street, leaving it to the traffic. One old couple had to sleep in the daytime because the traffic interrupted their sleep at night. Another resident was so angry he said he wanted to dynamite the street to stop "these Marin (county) commuters" from coming through. Despite the street's pleasant appearance, its environment was inferior to the slightly less immaculate LIGHT street. The ultimate irony was that the rents were higher on the HEAVY street, probably because of the faster turnover of apartments.

Life on LIGHT street, on the other hand, was in some ways idyllic. Residents were much more engaged in the street. They saw it as their own territory. Their children played on the sidewalk and in the street. They had many more friends and acquaintances, and they were generally much more aware of its detailed qualities. The contrast between the two streets was striking. On the one hand alienation, on the other friendliness and involvement.

10,000 Vehicles
20,000 Vehicles
30,000 Vehicles
Streets with Predominantly Residential Frontage

Yet LIGHT street had its problems too. For many, the occasional hot-rodder was more of a disturbance than all the traffic on HEAVY street. When people expect traffic to be heavy they tend to adapt to it and tolerate it. When they expect it to be safe, a hot-rodder can be especially dangerous. Those on LIGHT street had more children and were therefore more vulnerable to intruders. On HEAVY street, the families with children had all left. The traffic had therefore forced an out-migration, a hypothesis which was partly confirmed when a later study tracked down some former residents in Marin County who had moved there because of traffic conditions (Kanigel, 1972). The lack of children partly explained the impoverished social life on HEAVY street; in fact, many treated the street more as a transient hotel than as a residence. On MEDIUM street these processes were also at work. As the traffic slowly increased, families were in the course of leaving. Those who remained expressed deep regrets at the demise of their street community.

What we see happening is a more complicated process than residents simply evaluating streets. When conditions deteriorate they adapt, withdraw, or migrate. Such adaptive responses dampen dissatisfactions. In addition, a kind of environmental selection process takes place, by which groups that can tolerate certain levels of traffic replace those who cannot. The selection process does not work perfectly, since some of the older inhabitants were too old to move from deteriorating HEAVY street. These "trapped" residents may suffer more than any others.

Other questions arise. Were these three streets typical of what

"Since they put on the new buses, you can't conduct a conversation in the dining room. To hear what's being said, you have to scootch your chair right up to the table. The noise has almost taken away the use of two rooms, (the living and dining) from us. After dinner, we have to use one of the rooms at the back of the apartment. We're going to turn one of the bedrooms into a sitting room just on account of this."

Adams, 1970

If the children have fled Franklin Street, advertising man Bernard Sheehan can shed some light on their disappearance.

Lanky, dark-haired Sheehan moved his red-haired wife and four girls (ages 6 to 11) to Laurel Hill, a more family oriented neighborhood, last year. Their three-story Victorian on the 1900 block of Franklin now bears a for-sale sign.

"The sidewalk there (on Franklin) is too narrow and the traffic just horrendous," says Sheehan. "From about three in the afternoon it's jammed."

The Sheehans wouldn't allow their children to use their bicycles on Franklin—not even on the sidewalk. Instead, "we would pack them and the bikes in the station wagon and off to Julius Kahn playground. There was nothing else to do."

Adams, 1970

goes on in all streets? What happens in lower-income neighborhoods where families may have to live on the HEAVY street? And what happens in more affluent neighborhoods? Did the one-way traffic on HEAVY street make things worse than if it were two-way? We also found that 60 percent of San Francisco's heavily traveled arterial streets were lined with residences (6). Would policies for mitigating impacts on these streets, through landscaping. walls. fences. street lighting. and alternative play areas be effective? And so on. The need for a more reliable study was clear.

Protecting San Francisco's Residential Neighborhoods   Meanwhile. the Department of City Planning had to come up with recommendations. On the basis of our small study. which was well-publicized and enthusiastically received by the news media (one newspaper repeated the interviews on the same street. and a television station made a film of it). the Planning Department. under its Director. Allan Jacobs. proposed that the City designate. as a key part of the Urban Design Plan (San Francisco City Planning Department. 1971) "protected residential areas" throughout San Francisco (7). These areas were to be protected from through traffic by devices such as "necking down" street entrances. bending alignments. landscaping. lighting. and sidewalk treatment. all of which would slow traffic down to a residential pace. In the following years. the city budgeted up to $300.000 a year for neighborhoods that wanted such schemes to be implemented. The successes. surprises. and failures of this program will be described in Chapter Eleven.

FIGURE 7.
San Francisco. Plan for protected
residential areas

Protected Residential Areas
Arterial Street
Collector Street
Arterial Street That Should Become
Local Street when Conditions Permit

2 The Ecology of the Street

To examine the impact of traffic on street life, we needed a theoretical model to relate in some structured way all the variables that might take part in the complicated interaction between traffic and residents. Figure 8 illustrates some of the complexities. The first view shows a pleasant and quiet residential street, which the residents can use for a variety of activities. The second view shows what happens when traffic begins to appear. A wide array of impacts, both visible and hidden, begins to take place. (In Figure 9 we shall call this Time T.) The third view shows some of the ways in which the residents adapt to, withdraw from, or modify their environment as defenses against the traffic. The views of the interiors of the dwellings articulate a number of the usually invisible effects. They point out that streets, which to passing drivers may seem calm and untouched by their passage, may in fact be suffering in many ways from their impacts.

We do not yet show any attempts to control the traffic itself, except through protest. These efforts are described in Parts Two and

FIGURE 8.
The ecology of street life: in pictures

Pleasant, Quiet Rooms   Adequate Parking   Safe Environment for   Many Outdoor Activities
Adjacent to Street   Sidewalks Safe for Play   Elderly, Handicaps   Like Gardening
    Emission Free Air   Clean Streets   Conversation with Neighbors
    No Noise, Vibrations

BEFORE TRAFFIC IMPACTS

29

FIGURE 8 (cont.).

Sleeplessness   Noise, Vibrations   Dust and Fumes   Disrupts Outdoor   Interrupting Sleep
Disrupts Conversation   Emissions   Conversation   Interfering with
                                             Danger to Elderly   Indoor Activities
                                             Danger to Children
TRAFFIC INTRUSION IMPACTS   Playing in Street

Adapt Interior Space   Grilles or Shutters   Walking or Supervising   Fences, Shrubs to   Move Quiet Areas to Rear
Migrating   Security Lights, Burglar Alarms   Childrens' Activities   Block Noise   Backyard Leisure Orientation
Unused Front Room Space   Debris   Group Protest Against   Children Play Inside
                          No Parking Signs   Congestion
                          More Street Trees for Buffer

ADAPTIVE RESPONSES
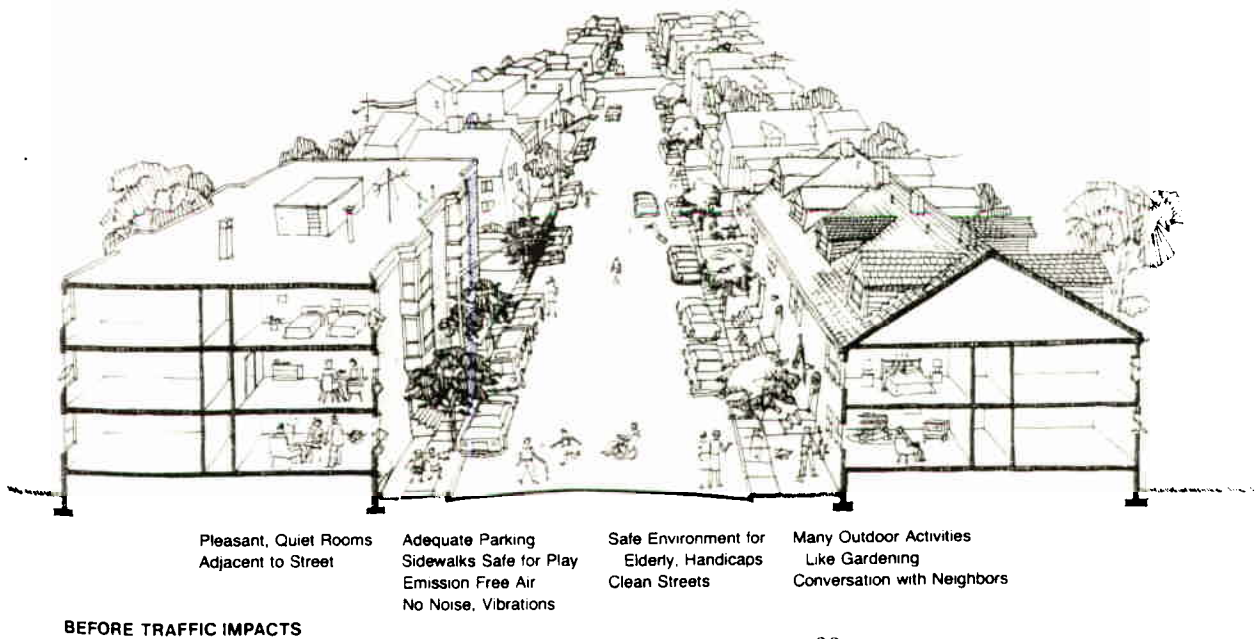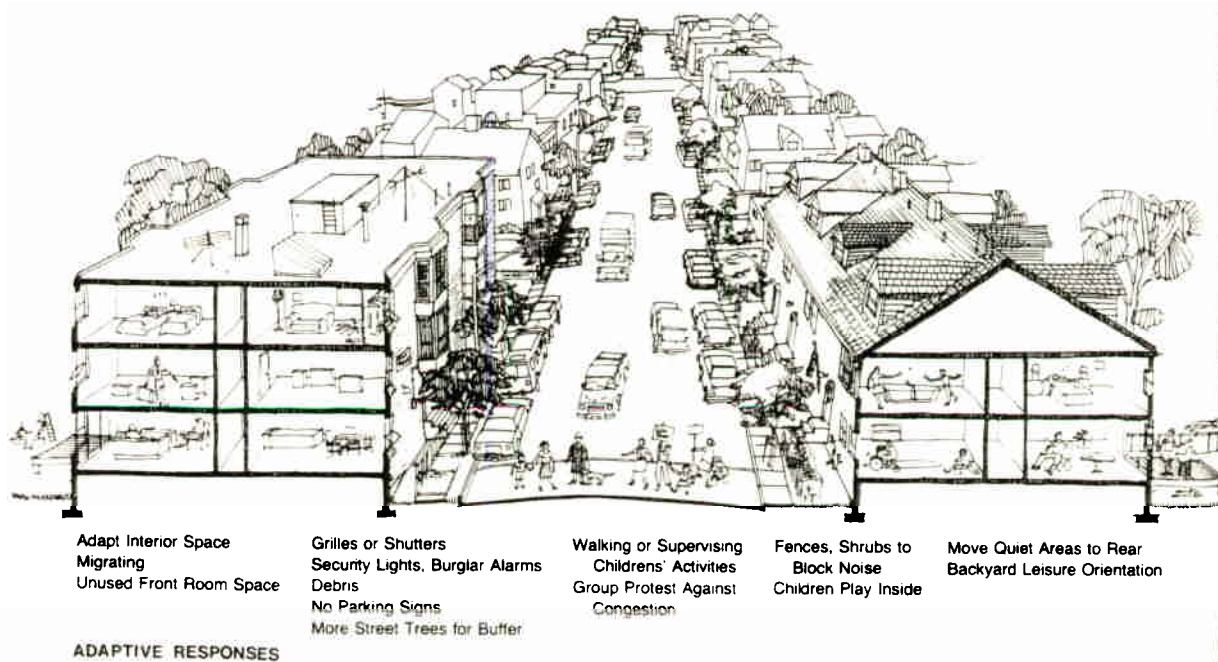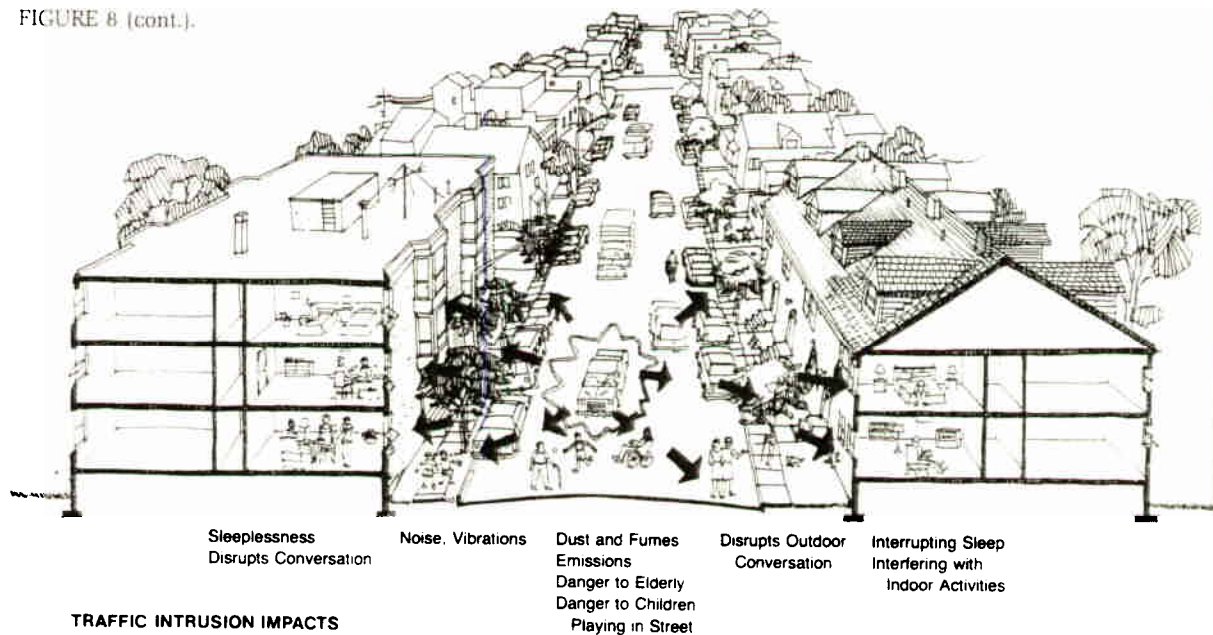
Three of this book. Clearly there is an ecology of impact, conflict, and adjustment that takes place on the street; only the symptoms of this ecology are illustrated here.

The model proposed abstractly in Figure 9 guided the next phase of our research and was in turn modified by it. It is a flow diagram
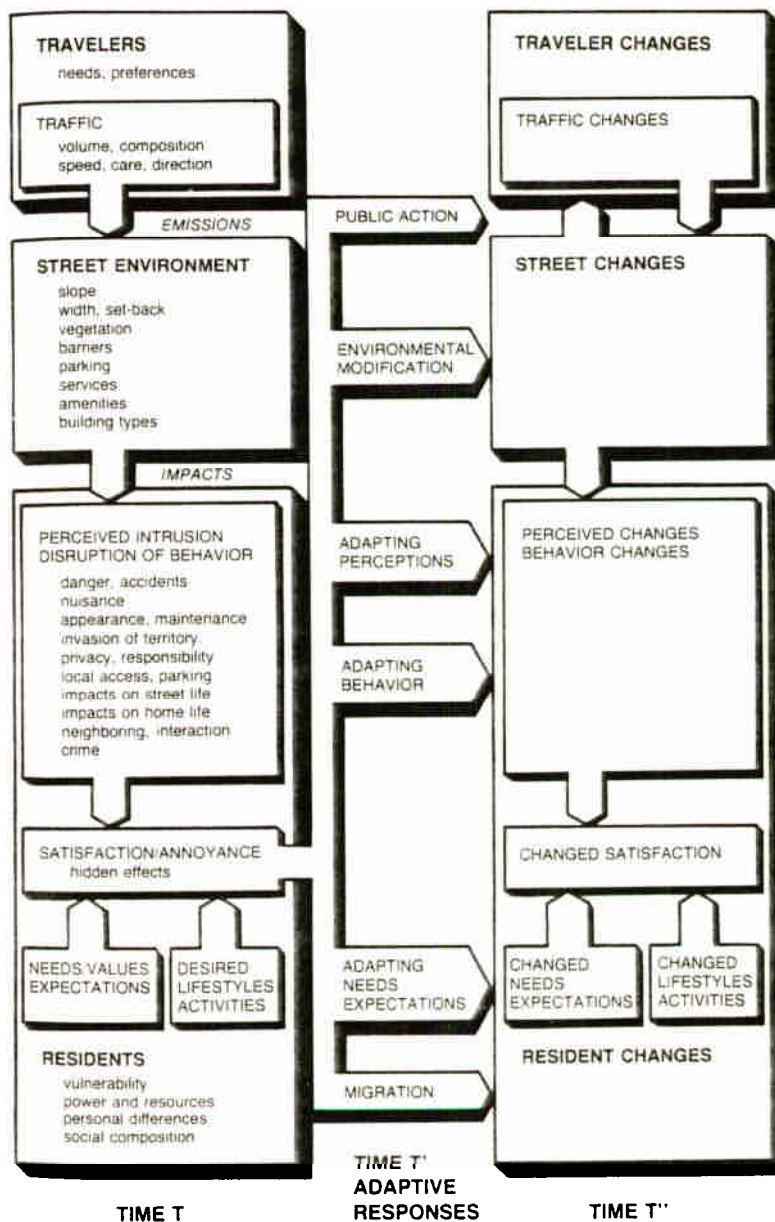
FIGURE 9.
The ecology of street life: a model

that describes the basic interactions and conflicts between travelers and residents over time, as mediated by the street environment. Rather than being a simple one-way traffic impact model, it describes how residents modify impacts through adaptive responses. It is in fact a microcosm of all environmental impacts and conflicts. The development of these interactions over time is symbolized by the representation of three time points (T, T', and T'') in the three columns reading from left to right.

The left-hand column (Time T) depicts the five main components of the interaction in a vertical array: the *travelers and traffic*: their *emissions*: the *street environment*: resulting *impacts*: and the *psychology of the residents*. The travelers who wish to use the street create the traffic. with its particular characteristics and emissions. The street environment affects both travelers and residents. To some degree it controls traveler behavior, and at the same time it modifies, magnifies, or compensates for environmental impacts at various points and places within the street environment.

The residents. with their own characteristics, come to the street environments with various needs and values. expectations. desired lifestyles and activities. When the residents encounter the street environment, they perceive intrusions or benefits and their consequent behavior is disrupted or enhanced. Their resulting satisfaction or annoyance is perhaps the most crucial of all the impact measures. However, there are many hidden effects. Their health. behavior, and view of the world may be affected by the environment without their knowledge or the knowledge of those who study the impacts.

If, as is common, residents are dissatisfied with the traffic on their street or other aspects of their street environment. they will engage in a number of *adaptive responses*. described at Time T'. The more modest will adapt their own levels of need, expectation. behavior, or perception. Others will modify their environment, or take public action to modify the street or its traffic. If none of these avail they may migrate from that street and be replaced by others who move in.

Time T" describes the adjusted situation. When studying a street at a particular time. it will be well to assume that it is Time T"—that is, that prior experiences and adjustments have been made which may explain some of the survey results. In fact, continuous changes and adaptations take place on streets. among travelers. residents, and the street environment. creating general patterns of change that will be described later.

This interactive model describes the ecology of traffic impact. It is still a simplified model. for "travelers" and "residents" are not always separable: residents also drive, and travelers reside. These are in fact the roles that people play. In the residential neighborhood people can think as drivers or as residents, and can value either mobility or livability; this can lead to personal as well as social conflicts. Also, extraneous variables such as population movements, the housing market, or other kinds of urban development can overwhelm or at least obfuscate the effects of traffic. It will be necessary to hold these complicating factors in mind.

Now, we should look at some of these variables in more detail.

Travelers and Traffic

Traffic is people. though sometimes residents who see speeding cars find this hard to realize. Travelers do need access. However, the automobile makes access so easy that it encourages laziness and greed. It is easy for travelers to speed casually along someone else's street. Controlling driver behavior depends very much on understanding and communicating with the driver's psychology—his perceptions, expectations, and attitudes.

Four attributes of traffic influence its impact: volume, composition, speed, and direction. Traffic *volume* is the most commonly used measure of traffic: it is usually measured on a daily basis (average daily travel, or a.d.t.). although in Britain the peak-hour volumes are

taken as the measure. Peak-hour volumes are approximately 10 percent of daily volume. The *composition* of the traffic, especially the presence of heavy impact vehicles such as trucks, buses, and motorcycles, can be of particular concern to residents. On the HEAVY street described in Chapter One, residents were able to differentiate the various kinds of buses and trucks that caused the most nuisance, which shows how aware residents are of traffic composition. Traffic *speed*, not only average speed but the speed of the exceptional hot-rodder, can be most disturbing to residents: higher speeds generate more noise, give pedestrians less warning of their arrival, and often result in screeching brakes, creating unpleasant tensions. Here the personality and behavior of the traveler is as much a problem as vehicle volume or type. Crucial here is the matter of driver *care*. If drivers were more considerate of the residential environment, their behavior would be less threatening. Finally, whether the traffic flows in a single *direction* on one-way streets or in two directions may well make a difference for residents, though there is debate on this subject.

Emissions

The emissions from traffic include noise, vibration, air pollution, dirt, trash thrown out of windows, and visual ugliness. Control of these emissions through vehicle redesign is an important way of increasing street livability, although we will not be measuring emissions in this study. Our concerns will be with affecting driver behavior.

Street Environment

The street environment performs two main functions in modifying or accentuating traffic impacts: (1) controlling traveler behavior; and (2) offering resident protection and compensation.

Controlling Traveler Behavior   Some of the characteristics that can control traffic volume, composition, speed, and behavior are road alignment (curved or straight), block length, slope, width, traffic signs and stop lights, pavement changes, street bumps, pedestrian crossings, barriers, street narrowings, landscaping, and other aspects of street character that make a street appear as a residential destination rather than a through channel. A descriptive list of such devices is given in Chapter Fifteen.

Offering Resident Protection and Compensation   The modification or accentuation of traffic emissions (noise, vibration, pollution), or the provision of compensating amenities, can be affected by characteristics of the street environment. The most critical factors appear to be:

Slope.   As street slope increases, downhill speeds may increase, as may noise emissions, vibration, and air pollution.

Width and Set-Back.   Street width, sidewalk width, set-backs, and front yards can all protect residents from traffic. The narrower streets of London and San Francisco, for instance, magnify the impacts of traffic compared with wider suburban streets.

Vegetation.   The presence of trees and shrubs, although they may do little to reduce noise and air pollution, can screen traffic, enhance appearance, and compensate for other disadvantages.

Barriers.   Fences, walls, and other screens may reduce noise, mostly in ground-level rooms, increase privacy, and prevent children from running onto the street.

Parking.   The presence of parked cars can act as a barrier protect-

ing residents from noise and visual intrusion. As potential traffic. however. it can also be a hazard in itself. Adequate or inadequate parking space can fundamentally affect the attitudes of residents toward their street.

Services. Street cleaning and maintenance and police patrols can do much to affect residents' pride in their street (or dependence on the city) and sense of security (or repression).

Amenities. Views. pleasant microclimate, children's play spaces, outdoor seating. street lighting. and other amenities can influence street satisfaction in many ways.

Building Types. Buildings offer degrees of protection from traffic. Building *heights* can increase echoes and trap fumes. and make residences on upper floors more difficult to protect. Building Continuity—expressed in row houses or continuous apartments. for example—can protect rear yards from noise while increasing reflections within the street environment. Solidity of construction and double-glazed windows can protect building residents from noise. vibration. and invasion of privacy.

Environmental Impacts

It is possible to measure the impacts of traffic on environmental qualities such as noise. air pollution. and vibration through instrumentation at specified points in the street environment. In many impact studies these measures have taken precedence over response measures. They have the advantage of objectivity. but they require careful sampling and their relation to responses has not been reliably established. although a British study (Hedges. 1974) correlated noise levels and responses over a nationwide sample of about 5.000 respondents. In this study we will concentrate on response measures.

Residents

The residents will concern us most in this study. They bring to the residential environment their own configuration of *needs. values. and expectations. and desired lifestyles and activities.* Much will depend on their vulnerability. resources. and social background. Street-dependent people, especially children, old people, the handicapped. and housewives. subcultures known for their street life and neighboring, or those without back yards or parks may be especially *vulnerable* to their street environment and traffic. Those with economic resources and political power are more likely to complain or protest actively against unwanted intrusion than those without power. although this will depend on the general political climate of the neighborhood and the city. Personal and social attitudes toward the automobile and the residential environment can vary. Those for whom the automobile is a newly acquired possession, for instance. may temporarily value mobility more than livability. Within families. the husband may invest more importance in the automobile than his wife, who is usually more concerned about the safety of her children on the street. This has been particularly true of first-generation automobile families.

Needs. Values. and Expectations What people want from a residential and street environment may be security. peace and quiet. comfort. cleanliness. attractive appearance, privacy. territorial control. convenience. good parking. street life. neighborliness. or other amenities.

Expectations can significantly affect perceptions and satisfaction. a point brought out forcefully in *Quality of Life in America* (Campbell and others, 1976), which discovered more satisfaction among lower-

income groups than among the affluent. The explanation must be that the former have lower expectations, for their living conditions are undoubtedly worse. The same may be true of street residents. The more affluent are likely to be more critical of their streets because they know of other choices, whereas lower-income groups may be satisfied with what they have.

Desired Lifestyles and Activities   The activities in which people engage or desire to engage in may affect their vulnerability to traffic impact. So many of these activities have been suppressed that we sometimes forget they exist.

Street Life.   Children wanting to play, and people talking, sitting, strolling, jogging, cycling, gardening, or working at home and on auto maintenance are all vulnerable to interruption.

Neighboring.   One of the most significant and discussed aspects of street life is the amount and quality of neighboring (Suttles, 1972, Gans, 1968, and Jacobs, 1961). Its interruption or "severance" has been identified as one of the primary measures of transportation impact in Britain (Lee, 1975).

Home Life.   Resting, sleeping, talking, eating, playing music, reading, studying, and watching television are among the many activities of home life which are affected by intrusions from the street.

Perceived Intrusions and the Disruption of Behavior   Resident perceptions, as we have just said, are affected by their background and expectations; they are not necessarily accurate or correct, given the selective nature of perception and its ability to screen out some percepts and sharpen others. For instance, gradual changes may not be noticed and the effects of sudden change may be exaggerated. Ten kinds of perceived intrusion and disruption have already been identified in San Francisco's three streets:

Danger and Accidents.   Traffic is in itself dangerous. Most children are killed or injured on streets near their homes. It can create the fear of danger, especially for parents of small children.

Nuisance—Noise, Vibration, Air Pollution, Glare.   Perceptions of these nuisances vary when inside and outside dwellings. Their perceived effects may be accompanied by hidden health effects. They may also pollute vegetation and other growing things.

Appearance and Maintenance.   Pride in the appearance of the street and awareness of it as a livable environment can be affected by the visual impacts of traffic and its emissions, and by the presence of trees, vegetation, and other amenities. Street maintenance and neighbors' upkeep play a significant role in the street's appearance.

Invasion of Territory, Privacy, and Responsibility.   Traffic can reduce the sense of personal territory, invade personal and family privacy, and negatively affect people's sense of responsibility for their street.

Local Access and Parking.   Traffic can cause difficulties in parking and driving around the neighborhood, as well as in walking, cycling, and taking the bus.

Impacts on Street Life.   Traffic can suppress children's street play, adult conversation, sitting out, gardening, and other street activities.

Impacts on Home Life.   Traffic can intrude upon the home, disrupting the most intimate aspects of family life.

Neighboring and Social Interaction.   Traffic can have a substantial effect on neighboring on the street.

Crime.   The effects of traffic on patterns of crime are only begin-

ning to be explored. It appears that streets with higher access are more susceptible to crime.

Social Change.   Traffic can encourage high turnover, especially of families with children, but also, as we shall see, of different social groups.

Satisfaction, Annoyance, and Evaluation

In a remarkable way, people are able to summarize their feelings or evaluations of a street environment despite its complexity. This synoptic assessment merges from an intuitive weighing of all factors that are salient to them at the time of response. However, much depends on their mental set and recall at that time. Global measures of satisfaction are therefore somewhat unreliable. We shall concentrate more on assessments of individual environmental qualities.

Satisfaction is elusive, too, because it is a *relative* measure, based on the interaction of desires and expectations on the one hand with the perceived reality on the other. The difference between these is the measure of satisfaction. The relation between aspiration level and satisfaction has recently been explored by Campbell and others in *Quality of Life in America* (1976). They found that the best predictor of current residential satisfaction was the difference between "best hoped for" place to live and a person's current situation. And this "best hoped for" standard was based on some combination of past best experience, relatives' neighborhoods, and their conception of what a typical American neighborhood was like. The past experience of the residents becomes therefore a crucial factor in their assessment of a street. When we later consider the likely patterns of satisfaction over time, we shall see how past experience can have a considerable cumulative effect.

Satisfaction can also be expressed at different levels of subjectivity. Responses to environments can range from the very subjective "it makes me feel happy" to the evaluative and judgmental "it is a good environment." Craik and McKechnie have distinguished in this way between preferential judgments, which are subjective, and comparative appraisals of different environments, which force a respondent to be more objective (Craik and McKechnie, 1974). They find that subjective judgments relate more closely to personality variables and therefore vary more within an environment, whereas objective judgments display more agreement between respondents when judging an environment. Both types of judgment are important, but it is useful to distinguish between them.

A commonly used indicator of satisfaction is property value. But it has even more weaknesses than satisfaction as a reliable indicator of environmental quality because it is based as much on ability to pay as on satisfaction, and therefore results from a compromise between desires and resources. On the other hand, we cannot depend entirely on satisfaction to evaluate impacts, for there may be hidden effects. Effects of traffic on physical and mental health are likely to be serious on heavily traveled streets, though we will not address that problem here. Constraints on behavior of which residents are unaware constitute another type of hidden impact. Measures of satisfaction alone should therefore be treated with caution.

Adaptive Responses

To reduce the negative effects of traffic on their street environment, residents can engage in a number of adaptive responses.

Public Action If conditions become intolerable, residents resort to public actions, exerting political pressure by talking to politicians, going to meetings, voting, or by taking more direct street action, such as milling-in or otherwise halting traffic. Street actions are usually not taken until people are desperate, as when a child has been killed by a passing vehicle: these actions are aimed more at changing the nature of the traffic or traveler behavior than at providing protection for residents.

Environmental Modification and Defense More active residents will try to modify negative impacts by changing their environment, erecting fences, planting trees, closing windows, and so on.

Adapting Perceptions Many can adapt their perceptions by screening out or ignoring unpleasant noise, fumes, or other nuisances. This explains the surprising tolerance that some people have for seemingly intolerable conditions.

Adaptive Behavior Unpleasant environments can force people to change their living patterns. They move to the back of the house, forbid their children to play in the street, even sleep in the daytime.

Adapting Needs and Expectations By lowering expectations to more modest levels, people can cope with unpleasant environments. Such attitudes of resignation are frequently found in interview responses.

Migration and Selection Finally, if no change seems possible, people will migrate. Another group or land use, either more adapted to conditions or more ignorant of them, will move in. Hence, if traffic increases, families may be replaced by childless couples, or, if the zoning allows, residential land uses may be replaced by commercial ones.

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 fewer but who valued accessibility tended to replace them.

The really important effects of these adaptations are that they compromise the validity of satisfaction and environmental impact measures. Unless the presence of these adaptations is explored we may find unwarranted satisfaction levels, which will convey an overly optimistic view of an environment to which people have merely resigned themselves. Such easy adaptations mask deeper distress or other hidden effects (Dubos, 1965).

Maladaptations and Mistaken Choices These processes of adaptation and selection suggest there is some perfectly functioning teleological process at work on the street. But this is not the case. These processes do not work perfectly, for a number of reasons:

Lack of Resources Many cannot select their preferred environment or adapt well to their current street environment because they lack financial, informational, or psychological resources to go anywhere else. Hence, many are "trapped" on disliked, unpleasant streets. On HEAVY

street, older people finding it too costly or too difficult to move (the friction of moving) experienced severe discomforts. The families who could not leave MEDIUM street were similarly depressed.

Trade-offs and Compromises 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 a desirable street like LIGHT street had less turnover, and were seldom on the market.

Inertia Many find the hassles of moving too great. Time and again we found respondents unwilling to go through the planning, the search, and the packing required to move to another residence.

Mistakes Others make errors of judgment in selecting a residence. They may visit it on the weekend, not realizing that traffic is heavy on weekdays. They may be deceived by good maintenance and not realize that the street is in a state of social change.

Unpredictability To predict future deterioration of conditions or sudden changes in land use or circulation patterns is beyond the capability of most residents—and often, of planners as well. This deterioration from original expectations caused much of the distress on MEDIUM and HEAVY streets.

Moving to me is the most atrocious job in the world because of all the junk you have to pack up and haul around. I'd rather take a beating than move.

Changes Over Time

The adjustments between Time T and Time T" merely symbolize patterns of interaction and adjustment that evolve continuously through the life of a street and its residents.

Two principal types of change take place on streets: traffic change and resident change. They may act independently of each other, or the traffic change may lead to a social change. To clarify how changes can affect a resident's attitudes toward the street, Figure 10 describes a typical resident's history of experience on a street.

1. *Prior Expectations.* Before coming to live on a street the prospective resident has some reasons for wanting to move; he visits the street and the house, makes an assessment of it, and decides to move in. A person's past, whether vividly imagined or half-forgotten, shapes his perceptions and attitudes toward a particular place or event. His expectations, hopes, and fears involving the future color his views of the present. Unless this psychological context is understood it is difficult to fathom responses to a situation, for people's attitudes toward an environment do *not* clearly correlate with measures of environmental qualities. We will find many anomalies—satisfied people on apparently unpleasant streets (See HEAVY COMMERCIAL in Chapter Ten), and unhappy people on apparently attractive streets (see Cloudesley Road, Chapter Nine).

2. *Arrival.* In the first months two things can happen. The first, and more likely, is that the new resident will be satisfied. For many, this is the "honeymoon" period; the decision to move has been made, and cognitive dissonance—anything that questions that decision—is suppressed. At the same time, in a "shakedown" period, most people also modify their new home to make it fit their particular needs. The second possibility is that the new resident will be disappointed, because his expectations are not matched by reality.

3. *Adaptation.* After some time, adaptations of various kinds will have been made and extreme feelings will cool; life becomes routine, expressed in terms of mild satisfaction.

4. *Deterioration.* If some deterioration later takes place—such as a traffic increase, a serious accident, social changes, the slow dilapida-

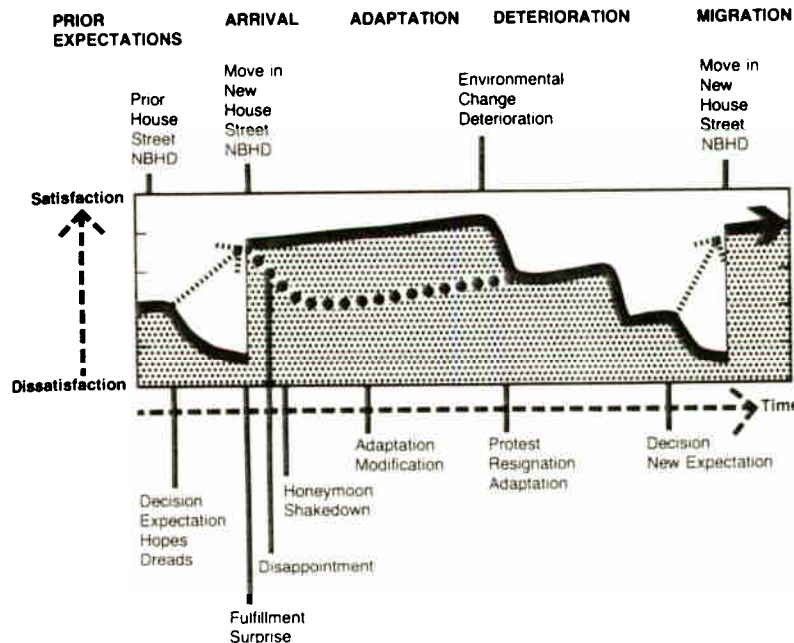| PRIOR EXPECTATIONS | ARRIVAL | ADAPTATION | DETERIORATION | MIGRATION |

FIGURE 10.
Street satisfaction over time. This graph seeks to explain why residents' levels of satisfaction will change depending on time of residence, environmental changes, and expectations of alternative residence. Newcomers will usually be satisfied (unless surprised by some unexpected situation); with adaptation and modification they will make conditions continually better (hence the rise in satisfaction in times of stability). Environmental changes, including traffic increases, or different populations can reduce desirability of the residence. They may protest or resign themselves to the change, but if it is too severe, they will ultimately decide to move.

tion of buildings, or proposals for new buildings—the resident may resist, feel helpless, or try to adapt. Rarely will any of these changes be viewed as improvements for the area, because the residents' expectations were formed at the time they chose their homes. They tend to see the change negatively, as it moves further from their notion of an appropriate place to live. Unforeseen changes are the most common sources of dissatisfaction in residential streets and neighborhoods. When interviewed at this time, a resident may be defensive in his response to an outsider. Still hoping for an improvement, or a halting of the decline, he may be reluctant to admit that he lives on a poor street. After all, if he is an owner, property values may decline. Typical of this period is a noncommittal response, "it's O.K."

5. *Migration.* If conditions deteriorate too far, and adaptive actions achieve nothing, the resident will decide to migrate. Once the decision is made his expressed opinion of the street may sink rapidly, as he compares it with his new choice.

The Crucial Difference between Incremental and Sudden Change
The changes described above are usually caused by independent actions and take place gradually. Traffic slowly increases, a new group begins to move into the neighborhood, the street cleaning service declines. Some are almost imperceptible and are adapted to with little strain, unless or until some breaking point is reached. This may explain why there has been so little protest against traffic increases compared with protests against freeway projects. The target for resentment is elusive and unclear.

In the San Francisco surveys reported next, interviews were taken under such relatively stable or incrementally changing conditions. Occasionally, however, a sudden dramatic change is planned: new building proposals, a change in the zoning ordinance, or a substantial

shift in traffic levels, up or down. Part Two of this book will deal with such planned and sometimes dramatic change, where neighborhoods become politically mobilized and resident reactions develop in a totally different and politicized context. The processes that take place in that situation will be summarized in Chapter Thirteen.