



NOISE-POLLUTION PERCEPTION
IN A CALIFORNIA UNIVERSITY TOWN¹

*Stephen C. Jett**

Noise--or unwanted sound--has, of course, long been recognized as a negative environmental factor. Only fairly recently, however, has it received much scientific study and political attention. In the Report of the Environmental Pollution Panel, President's Science Advisory Committee of 1965, noise was recognized as an "environmental pollutant that affects people psychologically and perhaps physiologically" but whose "clinical significance is unknown." The Panel merely recommended that local sound-insulation codes be adopted for apartment buildings.² However, the negative physiological, psychological, and social effects of occupational and environmental noise--such as hearing damage, sleep disturbance, contribution to anxiety and to stress-related diseases, communication disruption, and the like--came to be increasingly documented, and during the late 1960s several federal agencies mounted an effort to increase the country's involvement in noise control. In 1972, Congress passed H. R. 11021, The Noise

*Dr. Jett is Professor and Chairperson of the Geography Department, University of California, Davis.

Control Act, which directed the Environmental Protection Agency (EPA) to set national noise-source standards, especially for motor vehicles and construction equipment, and otherwise to promote "an environment for all Americans, free from noise that jeopardizes their health or welfare," by coordinating federal programs, by giving state and local technical assistance, and by other means. In the period between 1973 and 1976, state and local noise-control programs--including the State of California's Office of Noise Control--increased from 288 to 665. In the meantime, the U.S. Department of Labor's Occupational Health and Safety Administration (OSHA) has become increasingly involved in setting and enforcing occupational noise standards.³

Perception of Noise

Although there is now a considerable literature on the health and safety aspects of noise, on its general environmental impacts, on legal implications, and on technical aspects of sound measurement, acoustical design, and the like,⁴ very little of this literature has been generated by, or is familiar to, geographers, and even less has dealt with the specifically geographical approach of environmental perception.⁵ Yet, a major part of noise's impact falls into the "nuisance" category--that is, annoyance rather than immediate and obvious health or safety effects.

Some 49 percent of Americans in 1974 considered their neighborhoods too noisy, and Americans queried in the same survey ranked noise first of all undesirable conditions listed.⁶

The question of what sounds under what conditions constitute nuisances is a subjective matter, but some measure of noise perception is essential for the establishment of community standards and regulations to control this form of pollution. It is with these considerations in mind that the present effort is made to present the results of two recent studies of noise perception in Davis, California.

Davis, California

Davis, California, is located some 14 miles southwest of Sacramento. It is noted as being a pioneering city in the development of bicycle pathways, energy-conservation building requirements, solar energy use in homes, and population growth control. In 1976 Davis had a population (including the University of California, Davis, dormitories, outside of the city limits) of approximately 38,800. Apart from a university-student population of over 17,000, the socioeconomic make-up of the city is relatively homogeneous, with few poverty-level or lower-class residents and few wealthy or upper-class citizens. Average educational levels are high, and much of the work force, (about 10,500 in 1975) is employed in academic and nonacademic capacities at the University. Other citizens are proprietors and employees of small commercial retail, service, and construction enterprises or are public employees and professional and business people who commute to Sacramento and elsewhere. Too, there are municipal and public school employees; employees of a utility company, a food-processing plant,

and a small metal-products factory; personnel of an insurance company and a small hospital; children; and retirees.

Unquestionably, the University is the dominant influence in the community, and the principle sociological dichotomy is between the "permanent," middle-class residents of the city, who live primarily in family organizations, and the individually temporary but collectively permanent student population, whose average age is about 20 years and who are largely unmarried but normally share living quarters with one or more students. For convenience, these two populations will be referred to as "family" and "student", respectively. Off-campus students (numbering about 11,000) live largely in apartment houses, with a minority in rented duplexes and single-family houses, whereas the bulk of families live in single-family houses.

The Noise-Perception Survey Questionnaires

Under state law, each California city, including Davis, is required to develop a Noise Element for its General Plan.⁷ In December, 1974, the Davis City Council appointed a 9-member Ad Hoc Noise Element Study Committee, including both professionals in the noise field and lay persons, and including professors, students, and nonuniversity members.⁸

Two surveys were conducted.⁹ The first was to measure perceptions of the nature, bothersomeness, and locations of annoying noise. The second was to determine attitudes regarding appropriate noise-control levels and means.

A different random sample was taken for each survey by

choosing for sampling every 41st and 49th address, respectively, from the customer list of Pacific Gas and Electric Company, the local utility (thus, dormitories--outside of city limits--were excluded). Households containing both male and female adults were asked to have a male respond if the street number was odd, and a female if it was even. Residence patterns of the two principal populations allowed a reasonably good division of the data into family versus student responses. For the first survey, returned questionnaires were sorted as to dwelling type to differentiate responses of these two populations. This was not done with the second survey since only overall popular opinion with respect to proposed regulations was being measured.

The Noise-Problem Survey

A two-page questionnaire was mailed to 334 residential addresses in May, 1975. Eighty-five (25.5 percent) at least partially completed questionnaires were returned.¹⁰ The questionnaire's purposes were to find out: 1) what noises Davisites consider problem noises, and which of these they consider the most bothersome; 2) when and how often these noises are annoying; 3) in what ways the most annoying noises bother people; and 4) the geographic distributions of worst-noise problems in Davis.

Instead of relying on respondents' spontaneous suggestions of bothersome noises, a list of likely noise sources was provided (in no particular order), so that no important source

would be overlooked by respondents. Respondents were also invited to add "other noises." A list of potential effects of noises was supplied, and comments were also solicited. Respondents, though anonymous, were asked to name the street intersection nearest their dwelling to permit geographical analysis.

Because of differing residential densities as well as to differentiate the two major populations in Davis, analysis of the questionnaires was divided into "apartments and duplexes" and "single-family houses"; data received from 10 duplexes were lumped with those of apartments because duplexes are two-unit apartments and because duplex responses appeared to be statistically similar to those of apartment dwellers.

Each respondent was asked to identify the externally generated noise sources which were "most bothersome," "second-most bothersome," and "third-most bothersome," at his or her residence. To weight noises statistically, a "most bothersome" noise was valued as 3, a "second-most bothersome" noise at 2, and a "third-most bothersome" noise as 1.¹¹ Each of the 18 noise sources in the questionnaire's list was considered to be a currently bothersome source by at least three respondents in each of the two residence categories. Most, but not all, of the sources listed were also chosen by one or more respondent as among the three noises most bothersome at his or her residence. These are discussed below, in order of importance. Data are fully summarised in Tables 1

and 2.

Automotive Noises. Automotive noises--motorcycles, cars, trucks, and busses--comprised by far the most frequently mentioned gross category of bothersome noises, accounting for 39 percent (with the weighting) of single-family-house residents' three most bothersome noise sources, and 35 percent of apartment dwellers'. Motorcycles showed up distinctly not only as the most annoying automotive noise source, but also as the overall most bothersome noise source, among both single-family-house residents (24 percent) and apartment-dwellers (18 percent). Automobiles took second place among all sources for apartment residents (14 percent), and third among single-family-house inhabitants (11 percent). Trucks were in 13th and 10th place, respectively, in single-family-house and apartment neighborhoods. Busses, though not on the questionnaire list, were mentioned by a few respondents.

Motorcycle noise appeared to cause particular problems in three separate areas. One was where "dirt-biking" was popular adjacent to the Southern Pacific Railroad tracks; a second was in a neighborhood near the cannery, where motorcycle-owning house-renting students and cannery workers are probably concentrated; and a third was in an area heavily populated by University faculty and other professional people (studies show a positive correlation between noise-consciousness and educational level¹²).

Car-noise annoyance is rather evenly spread throughout

town, indicating that street rather than highway car noise is more significant (two freeways and a county road pass through Davis). Somewhat higher-than-average annoyance appears among residents of the northern and western core area, where traffic is heavy. Several respondents mentioned "hot-rodding" as a particular problem. Because of traffic restrictions, truck noise is primarily a phenomenon associated with the three major thoroughfares. Truck traffic--much of which goes to and from the cannery--is especially heavy during the late summer-early fall harvest season. Since this survey was taken in May, response to truck-noise annoyance was probably not as great as would have been the case at harvest time.

Automotive noise tends to occur every day. Its largest single negative effect is sleep interference, although it also bothers people in a wide range of other ways, such as causing tenseness and interfering with study, etc. Overall, problems are more a daytime phenomenon in single-family-house neighborhoods and more an evening one in apartment areas, but substantial annoyance occurs in daytime, evening, and nighttime.

Pets. Pets, apparently mainly barking dogs, but to some extent cats, are Davis' number-two noise problem in single-family-house neighborhoods (19 percent of the three most annoying noises), and number-three in apartment areas (12 percent). Annoyance is very frequent, almost daily, among respondents, although not as frequent as with automotive noise. Annoyance levels are highest at night, and sleep interference is the

greatest single problem caused, but significant annoyance is recorded at all times of day, and the whole range of annoyance effects, particularly tenseness, are given significant mention.

Pet-noise problems are fairly evenly distributed over the city, although one or two areas seemed to experience higher levels of annoyance, for reasons that are unclear.

Amplified Sound. After automotive noises and pets, the various forms of amplified sound--"radios, TV's, hi-fi's live bands, and parties" (exclusive of "live human voices")--are the most frequently mentioned bothersome noise sources among respondents, even though they occur only occasionally. This gross category ranks third among single-family-house residents (8 percent of the three most annoying kinds of noises), and second among apartment dwellers (16 percent). Among the former, such sound of outdoor origin ranks fifth in the list, whereas such sound of indoor origin ranks tenth. For apartment-dweller respondents, indoor amplified sound is more important (third place), whereas, outdoor amplified sound ranks lower (seventh). The importance of indoor sound in apartment complexes reflects multi-unit living, high-volume sound, and poor sound insulation between units. In the student Housing Viewpoint survey, many apartment-dwellers mentioned this kind of noisiness as a problem.¹³

Frequency of amplified music, etc., is less than that of the noises discussed above. Such sounds are annoying particularly during the evening and at night, and cause nearly the whole range of annoyance effects, particularly sleep and study

interference and tenseness. Outdoor music significantly discourages yard use and interferes with conversation in single-family-house neighborhoods. The data do not show any clear geographic concentration of outdoor amplified-sound problems. This may reflect wide distribution of loud private parties as well as the fact that amplified music from campus, apartment-house, and fraternity-sorority outdoor social events can transmit sound a mile and a quarter or more.

Live Human Voices. Vocal noise, though not very annoying to homeowners (thirteenth in rank), was quite important (fifth place, 11 percent) to apartment inhabitants. The reason for this, and the effects, are similar to those relating to indoor radios, hi-fi's, etc.

Railroad. A major junction on the Southern Pacific's main east-west line exists in downtown Davis. The railroad ranks fifth (8 percent) among the noises listed as among the three most annoying to apartment dwellers; sleep-interference is the primary negative result, and most of the other negative effects are also felt by some for whom railroad noise is a fairly frequent annoyance. Nighttime switching, as well as through trains, create annoyance.

The problem areas are localized according to the location of the railroad tracks and the density of nearby population; relatively distant areas record little or no railroad-noise annoyance. Very clearly, the main complaint area is that occupied by apartment houses along the two streets adja-

cent to the north-south tracks.

Because of the fixed locality of the railroad and its well recognized noise-causing qualities, it is probable that most people sensitive to this form of noise try to avoid neighborhoods near the tracks, thus partially accounting for the fact that train-noise annoyance, though important, is not listed more frequently than it is.

Aircraft. Although aircraft noise ranked only twelfth of those sources listed by apartment residents as among the three most annoying, it was number four (8 percent) in single-family-house areas, and such listings were virtually absent in the northeastern part of the city. Annoyance generally increased westward to a peak at the westernmost neighborhood, and occurred a few times per week. It is therefore certain that the University airport located near the above-mentioned neighborhood is the principal source of aircraft noise pollution in Davis, although crop-dusters were also mentioned. The City has also received complaints about low-flying military, police, and flying-club helicopters. Principal effects of aircraft noise are awakening from sleep, and conversation and study interference.

Power Tools. Power lawnmowers, chain saws, edgers, and the like were house-dwellers' sixth-most annoying noise category, and apartment denizens' tenth. The effects on people more or less run the gamut, but early-morning awakening and interference with study seem to be the main ones.

Air Conditioners. These stationary machines, often placed in narrow side yards or beside apartment buildings, caused bothersome noise number seven for homeowners, and number eight for apartment people. They are, of course, seasonal in operation, but their noise is frequent at those times of year. Negative effects on sleep and other activities sometimes occur, especially if the machines are poorly maintained. Sound from well-maintained air-conditioners is continuous and broadband, and far less annoying than the rattles and pulsing hums of poorly mounted or maintained units.

Trash and Garbage Collection. City trash and garbage collection, including street-tree and utility-company trimmings collections, were eighth and ninth, respectively, for apartment and single-family-house dwellers. Early morning awakening a few times a week or month is the main complaint. It has also been noted that trash collection sets dogs to barking.

Minibikes, Go-Carts, and Model Planes. These recreational machines were eleventh for householders and twelfth for apartment respondents among the three most annoying sounds, although some respondents probably classed minibikes with motorcycles. People annoyed were bothered a few times a week, and in several ways. This is essentially a daytime problem where it exists at all (around parks, playgrounds, parking lots, and the like).

Sporting Events. Because of their relative infrequency and limited locations, sporting-event noise ranked only eleventh

and fourteenth for house and apartment occupants, respectively. The significant sources of noise seem to be the University football field--especially the announcing during games--and, less importantly, the High School football field. The actual amplified words of the University football announcer can sometimes be heard inside closed houses over two-thirds of a mile from the field.

Commercial Noise. Commercial noise, such as deliveries, are fourteenth and fifteenth in rank for householders and apartment people. The main problem appears to be early-morning deliveries awakening residents; effects are no doubt localized.

Other Noise Sources. Swimming-pool splashing, filter pumps, etc., annoy some apartment dwellers, and probably a few homeowners. Factory and construction noises seem not presently to cause serious annoyance, although early-morning starts on the latter may occasionally awaken people. The City has received complaints regarding pneumatic drills. Volunteered annoying sounds included car horns, tire-squealing, sirens, (which have increased since this survey), a city water pump, typewriters, farm machinery, pounding by a child, and crows.

The Noise-Control Attitude Survey

Having gathered data concerning those noise sources which were most bothersome to the public, the Committee endeavored, by a second questionnaire, to ascertain people's

thoughts on appropriate legal controls of the most important noise sources. Since regulation of automotive noise is preempted by state and federal standards, our relevant questions involved only attitudes toward enforcement and sound-barrier construction. However, to obtain an information base for a proposed municipal noise ordinance, questions on possible regulation were asked with respect to pet noise, amplified sound, power tools, and trash and garbage collection. A sample of 250 addresses was selected and surveyed in January, 1976; stamped return envelopes were included, and 150 (62.5 percent) at least partially completed questionnaires were returned, plus 10 (2.5 percent) returned as undeliverable. The 22 questions were not arranged in any special order; their analysis below follows the order of importance of the noise sources as determined by the earlier questionnaire.¹⁴

Automotives Noises. Nearly 82 percent of those responding felt that the police should be instructed to place a higher priority on enforcement of state and federal laws related to the loudness of motorcycles and other vehicles. Many respondents underlined "motorcycles" in the question.

On the issue of allocating funds to erect barriers against vehicular noise in impacted areas, 54.5 percent replied negatively while 45.5 percent were in favor.

Pets. When presented with various duration options, more than 15 percent of the respondents to questions on pet noise felt that dog barking should not be allowed at all,

and an additional 38.3 percent felt that 5 minutes should be the maximum legal limit. A fifteen-minute maximum was chosen by another 33.6 percent; thus, 87 percent favored a limit of 15 minutes or less ("one hour" accounted for 8.2 percent, "more than one hour" for 4.8 percent). Almost 75 percent felt that if an owner cannot or will not prevent his dog from barking longer than the time limits they favored, the animal should be removed and delivered to the animal shelter. This is particularly striking in a relatively animal-loving community.

Amplified Sound. Outdoor amplified-music parties and concerts sponsored by apartment complexes, fraternities, and the like have generated considerable public complaint in Davis. Though these events have a good deal of student support, many residents of single-family neighborhoods have expressed their belief that the sound-level, duration, time of night, and frequency of such occurrences are excessive. Since this particular issue, unlike other noise issues, has received so much public attention, questionnaire responses should be viewed with this in mind.

Over 83 percent of those responding felt that amplified music at public dances and concerts should not be allowed to exceed levels that may cause permanent hearing damage. An overwhelming 96.6 percent agreed that amplified sound must never exceed levels detrimental to the health of those not attending the performance.

In response to the question "How often should people's amplified sound be allowed to disturb others?," 36.5 percent of those responding (8.7 percent did not respond) answered "never". An additional 19 percent wished to allow such disturbances only on a limited number of holidays. With another 10.2 percent favoring a frequency of no more than once a month, a total of nearly 66 percent felt that such amplified sound should be permitted once a month or less. Fewer than 14 percent of total respondents felt that such disturbance should be permitted daily, with an additional 20.4 percent expressing approval for restriction to Fridays and Saturdays only.

Those individuals favoring allowing at least some occasions upon which disturbance of people in their homes would occur were asked to choose at what point the disturbers should be required to desist. Of those answering, the largest number, over 35 percent, believed the disturbance should cease upon receipt of the first complaint. Another 22.7 percent thought that several complaints should first be received. Thus, 58 percent believed citizen complaint should terminate disturbance even on special days on which amplified music is allowed. For virtually all of the remaining 42 percent, such events should be allowed to continue, even if disturbing, no later than 8:00 P.M. (3.1 percent), 10:00 P.M. (15.6 percent), 12:00 A.M. (17.2 percent), or 1:00 A.M. (5.5 percent).

The idea of a limited number of more permissive "noise days" to which large outdoor events featuring amplified music

would be confined originated in a series of meetings of irate citizens, apartment-house and fraternity representatives, the Police Department, and the District Attorney's Office, and voluntary guidelines were applied in 1973 to one part of town. Knowledge of this probably conditioned questionnaire responses. Those respondents favoring designation of such "public-party days" could indicate the maximum duration which those events' disturbingly loud music should be allowed to last. Nearly 23 percent said 5 minutes; other choices were: half an hour (15.9 percent), 1 hour (14.1 percent), 2 hours (11.5 percent), 3 hours (16.8 percent), four hours (11.5 percent), and five hours (4.4 percent). There was clearly some ambiguity in the question, with some respondents interpreting it to mean allowed time to comply with an order to desist, others viewing it as meaning maximum duration assuming that complaints would not be cause to terminate parties or concerts. One may hypothesize that the bimodality of the responses reflect a division of opinion between the city's two principal populations.

Power Tools. When asked whether there should be restrictions on the loudness of power tools even if that meant certain types would be prohibited, 43.5 percent said yes, 56.5 percent said no. Power-tool noise in residential areas should be prohibited before 9:00 A.M. according to 43.6 percent of the sample, before 8:00 A.M. according to an additional 29.5 percent, before 7:00 according to another 16.1 percent, before 6:00 for 4 percent more. Some 6.7 percent felt there should

be no temporal restrictions.

Trash and Garbage Collection. Over 71 percent of respondents did not care to restrict sound-levels of trash compressors, tree-trimmings shredders, etc., if this would require use of less efficient equipment. However, most felt such machinery should not be used near residences before: 9:00 A.M. (14.9 percent), 8:00 A.M. (an additional 21.6 percent), 7:00 A.M. (an additional 13.1 percent), or 6:00 A.M. (another 14.7 percent). Thus, although 11.5 percent favored no time restrictions; nearly 70 percent preferred that trash collection occur only after 7:00 in the morning.

Discussion and Conclusions

Since Davis is usually thought of as an at least moderately permissive, "do-your-own-thing" town, the rather stringent restrictions on noise favored by residents is perhaps somewhat surprising. For example, three-quarters of the residents as reflected in the sample favored sending dogs that barked for more than 10 or 15 minutes to the pound, two-thirds believed that disturbingly loud musical events should not occur more than once a month, and 58 percent felt that even on these occasions, one or several citizen complaints should result in abatement. Perhaps the explanation lies in the facts underlined in the first survey, that noise is significantly bothersome to large numbers of people. For motorcycles, pet barking, amplified music, and cars seem to be serious sources of annoyance, with other sounds contributing

to the problem in lesser degree. Furthermore, Davisites are unusually well educated and environmentally and politically aware and many engage in activities requiring mental concentration. Davis' high level of concern about noise is also consistent with the Bureau of the Census' 1974 survey, in which noise was the most frequently indicated undesirable condition, and with L. R. Jacoby's 1969 findings for Detroit, where respondents expressed a higher level of concern about noise pollution than about air or water pollution. Too, in Sacramento, in 1974, "Pollution, such as too much noise, litter, smog, and water pollution," was viewed by residents as the most serious problem (of a list of 29) in their lives.¹⁵

Results of the few noise-attitude surveys from other American cities are not fully comparable, due to differences in sampling, questions, noise categories, and analysis. Nevertheless, it is of some interest to compare the results of Davis' first survey with similar surveys from other locales (I know of no survey similar to Davis' second). In 1966, 259 households in Los Angeles, Boston and New York were surveyed. It was found that traffic was the most universally bothersome general noise source, closely followed by "children and neighbors"; planes, animals, industry, and trains, were lesser sources. Since large, diverse urban areas are involved here, and the survey was a decade earlier than Davis', it is not surprising that the results--to the extent they can be compared--are somewhat different. A 1976 survey of urban and rural

Washington state revealed the following order of annoyance: traffic, aircraft, radio/television, industry, don't know/other, and office.¹⁶

More similar to Davis' perceptions were those of residents of Tulare County, California (principal city: Stockton), in 1973 reported the following order: motorcycles, other vehicular traffic, barking dogs, trains, miscellaneous, neighbors, industry, planes, and practicing bands.¹⁷ Notable is the lack of "amplified sound" and the presence of "industry" in these lists. The former is no doubt partly subsumed under "neighbors"; in Davis, its particular importance presumably reflects the sizable student population. The lack of heavy industry accounts for little concern about industrial noise.

There are several approaches to control of environmental noise in a community. The EPA has established noise-emission standards for various categories of motor vehicles and machines. The State of California has also established stricter motor-vehicle sound-level maxima. Enforcement of these would go far towards alleviating traffic-noise problems, but practical considerations inhibit this; a particularly common problem is illegal modification of mufflers by motorcycle owners. The State and City have adopted sound-insulation standards for various types of buildings, including multiple-unit dwellings, as specified in the 1973 Uniform Building Code.¹⁸ This law--if enforced--should significantly improve the noise situation in new apartment buildings. As for Davis,

the City Council adopted a Noise Element in 1976, which included in its action programs: incorporation of noise assessments in environmental-impact reports and in planning, zoning, and design decisions; enforcement of state and federal building-code and vehicle-emissions standards; establishment of priorities for sound-barrier erection; passage of a comprehensive municipal noise ordinance; and specifying of "a certain number of quiet and noise days."¹⁹ It is too early to assess the degree to which these action programs of the General Plan will mitigate noise problems, but a few steps have been taken. Among these are the joint acquisition with the County of a few sound-measurement devices, and the requesting or requiring that developers erect noise barriers along highways. At this writing, the City Council is considering three possible noise ordinances for adoption: the League of California Cities Model Noise Ordinance, the State Office of Noise Control Model Noise Ordinance, and an amplified and modified version of the latter drafted by Davis' noise-study committee to meet the special character and needs of the city, as determined by our surveys. As always, the ultimate success of any such ordinance will depend more on its enforcement by the City and on the understanding and good will of the public than upon the specific provisions of the law.



Three most annoying noises														All noises							
Rank	Noise Source	Importance	Frequency				Effects							Annoyance times			Frequency				
			Daily	A few/week	A few/month	A few/year	Prevents sleep	Wakens	Tense-ness	Startles	Interference with Yard Con-versation	with Study, etc.	Day	Eve	Night	All the time	Frequent-ly	Occasion-ally	Hardly ever		
1	Motorcycles	62	13	7	5	1	8	13	16	12	4	6	12	28	17	12	6	9	16	7	
2	Pets barking, yowling, etc.	50	11	6	2		11	13	10	7	10	3	9	16	14	22	4	8	13	13	
3	Automobiles	29	12	3			5	5	7	5	2	5	8	19	13	12	9	5	11	7	
4	Aircraft noise	20		4	1	2			3	1			2	13	10	6		8	17	11	
5	Radios, TV's, hi-fi's, live bands, & parties (outdoors)	15		2	3	4	4	1	4		5	3	5	7	11	14		3	17	12	
6	Power tools (mowers, edgers, chain saws, etc.)	13		6	2		1	4	4		3	2	4	25	5			10	13	10	
7	Air conditioners	12	4	3			1	1	2	1	2	1	2	12	7	4	1	10	1	15	
8	Railroad trains	11	1	1	1	2			1				3	1	6	6	17	1	7	8	13
9	Trash & garbage collection	10		2	4				5				1	21		3	2	5	11	11	
10	Radios, TV's, hi-fi's, live bands, & parties (indoors)	7			2	2	4	1	4	1	1	2	3	4	10	11	2	2	9	15	
11	Minibikes, go-karts, model planes	6	1	2		1	2	2	2	2	3	1	3	21	4	1		2	4	20	
11	Sporting events	6			1	2	1					2	1	3	5	2		4	5	19	
13	Trucks	5	3						1		1	1	1	15	6	9	4	3	14	11	
13	Live human voices	5					1	3	1	1	1	1	1	8	6	7	3	4	5	17	
13	[Buses]	5					1	1	2	2	1	1	1				1	1	1		
14	Commercial noises	2	1										1	12		2	1		9	18	
	Construction noise	0												12	1			2	8	17	
	Factory noise	0												3						24	
	Swimming pool noise	0												10	5	2		2	6	20	
	Other noises	6					1	1					1								

Table 1.
RESULTS OF CITY OF DAVIS NOISE SURVEY, 1975: SINGLE-FAMILY-HOUSE RESIDENCES
(Sample size = 44)

Rank	Noise Source	Importance	Three most annoying noises										All noises							
			Frequency				Effects						Annoyance times			Frequency				
			Daily	A few/week	A few/month	A few/year	Prevents sleep	Wakens	Tense-ness	Startles	Interference with: Yard use	Conver-sation	Study, etc.	Day	Evening	Night	All the time	Frequent-ly	Occasion-ally	Hardly Ever
1	Motorcycles	44	11	5	3		9	10	12	11	1	8	11	15	16	12	8	8	7	7
2	Automobiles	35	11	1	1		8	7	6	3	1	6	6	14	17	17	13	5	10	5
3	Pets barking, yowling, etc.	29	7	4	1		5	2	6	4	3		6	8	13	14	2	8	13	7
3	Radios, TV's, hi-fi's, live bands and parties (indoors)	29	2	3	6		6	3	6	1		6	7	5	12	14	2	6	12	6
5	Live human voices	28	4	2	6		7	4	4	1		1	6	7	8	17	3	6	13	8
6	Railroad trains	19	6	3			4	4	4	3		4	3	5	12	15	3	9	7	7
7	Radios, TV's, hi-fi's, live bands, and parties (outdoors)	12	3	1	3		5	2	3	2	1	3	6	4	12	7	1	3	11	11
8	Air conditioners	8	1	3			2					1	1	4	6	2	1	4	5	15
8	Trash & garbage collection	8		5			2	4	1	2			2	16		2	1	6	6	13
10	Power tools (mowers, edgers, chain saws, etc.)	7	4	2			2	4	3	1		1	5	13	2			6	7	11
10	Trucks	7	3				3	2	2		1	2	2	13	5	6	3	3	8	12
12	Aircraft noise	6	1	1		1	1	1	1	1		2	1	6	5	2	1	1	5	18
12	Minibikes, go-karts, model planes	6		3					1	1				7	1			2	3	18
14	Sporting events	4		2					1		1	1	1	1	4	1		1	2	17
15	Commercial noises	2	1		1		1	1	1	1		1	1	10	1	2	3		5	15
15	Swimming pool noises	2		1			1	1				1	1	4	2	6	1		2	17
	Construction noise	0												7				1	2	20
	Factory noise	0												3	1				1	19
	Other noises	3										1	1	3	3	2		3		

Table 2.
RESULTS OF CITY OF DAVIS NOISE SURVEY, 1975: APARTMENT & DUPLEX RESIDENTS
(Sample size = 40)

NOTES

¹A preliminary version of this paper was presented as: Stephen C. Jett, "Noise-Pollution Perception in a California University Town." Abstract in: *Yearbook, Association of Pacific Coast Geographers*, Vol. 40 (1978), 161.

²Environmental Pollution Panel, President's Science Advisory Committee. *Restoring the Quality of Our Environment*. Washington: The White House, 1965, 9, 23, 95.

³U.S. Environmental Protection Agency. *Toward a National Strategy for Noise Control*. Washington: Environmental Protection Agency, 1977, viii, 1.

⁴Recent general studies include Donald Athrop, *Noise Pollution*, Lexington, Mass.: Lexington Books, 1973; Karl D. Kryter. *The Effects of Noise on Man*, New York: Academic Press, 1970; Clifford R. Bragden, *Noise Pollution: The Unquiet Crisis*, Philadelphia: University of Pennsylvania Press, 1972; David M. Lipscomb, *Noise: The Unwanted Sounds*, Chicago: Nelson-Hall Company, 1974; Lucy Kavalier, *Noise: The New Menace*, New York: The John Day Company, 1975; Malcolm J. Crocker, A. J. Price, and F. M. Kessler, *Noise and Noise Control*, Cleveland: CRC Press, 1975. The EPA and other agencies have published many technical and other reports; for example, *Information on Levels of Noise Requisite to Protect Public Health and Welfare With an Adequate Margin of Safety*. Washington: U.S. Environmental Protection Agency, 1974; The Fairmont Press, Atlanta, has published several books on industrial and other noise control; see, too: Melville C. Branch, Samuel Gilman, and Charles Weber, "Monitoring Community Noise," *Journal of the American Institute of Planners*, Vol. 40 (1974), 266-73; Urban Systems Research and Engineering, *The Audible Landscape: A Manual for Highway Noise and Land Use*, Washington: U.S. Department of Transportation, 1974; M. Rettinger, *Acoustic Design and Noise Control*, Third Edition, 2 vols. New York: Chemical Publishing Co., 1977. On legal matters, see

Sherie-Ann Abbosi, *Current Legal Literature on Three Aspects of Ecology: Air, Noise, and Water Pollution, 1969-1974*, Council of Planning Librarians Exchange Bibliography, 740. On citizen action, see Theodore Berland, *The Fight for Quiet*, Englewood Cliffs: Prentice-Hall, 1970.

⁵Studies by geographers include: Kenneth Allan Bauman. "Urban Noise as a Factor in Planning." M.A. thesis, The University of Alberta, Edmonton, 1971; N. Helburn and Tim Tschinkel, "Toward a Geography of Noise," and William Sterling Kerr, "Noise Pollution Research Potential in Geography." *International Geography 1972 La Géographie Internationale*, 1, 639-41 and 645-47, respectively; Louis R. Jacoby, *Perception of Air, Noise and Water Pollution in Detroit*, Michigan Geographical Publication, 7 (1972); Herbert G. Kariel, "Perception of Noise in Campgrounds," In: *AAG Program Abstracts, Salt Lake City*, Edited by A. David Hill and Theodore C. Meyers, Washington: Association of American Geographers, 1977, 80; Bartolome Barcelo y Pons. "Aproximacion a una Geografia del Ruido," *Estudios Geograficos*, 36 (1975), 1-29. Although not a geographer, Gordon M. Stevenson, Jr. has written "Noise and the Urban Environment," for Thomas R. Detwyler and Melvin G. Marcus, eds., *Urbanization and Environment: The Physical Geography of the City*, Belmont: Duxbury Press, 1972, 195-228.

⁶Environmental Protection Agency, *op. cit.*, p. 6. citing the Bureau of the Census' 1974 Annual Housing Survey.

⁷This law, passed in 1971, is now Section 65302g, *California Government Code*. Division 28 of the *California Health and Safety Code* established the Office of Noise Control, State Department of Health, which aided in the collecting of technical data for Davis' Noise Element.

⁸City Council Resolution 1586. Individuals serving on the committee during some or all of its life included Charles W. Beadle, Ph.D.; Edward Bloomberg, Ph.D.; Marlene Bloomberg; Kenneth W. Collier; Stephen Henry; Stephen C. Jett, Ph.D. (Vice Chairman); Keith Kramer; Lynn Marchand; Dougall MacClise; Russ Suey; and Paul Taloff, M.A. (Chairman). Among

those consulted on, but not responsible for, the format of the survey were Prof. Robert Sommer (Psychology) and Prof. John Moore (Mathematics).

⁹Ad Hoc Noise Element Study Committee. *Report of the City of Davis Ad Hoc Noise Element Study Committee*. Davis: Planning Division, Department of Community Development, 1976, 124-43. Although tabulation and analysis of the first questionnaire were accomplished by the present author, tabulation of the second questionnaire was done by Planning Division employee Helen Dinsdale, and preliminary analysis was undertaken by Edward Bloomberg. Errors of calculation in the original have been corrected. I wish to thank Dennis J. Dingemans for editorial suggestions respecting this article.

¹⁰This relatively low return was primarily due to the City's failure to enclose return envelopes with the questionnaires. Other probable reasons include: 1) some people's feeling no noise was sufficiently bothersome to motivate return of the questionnaire (only one respondent indicated that no noises bothered him); 2) procrastination; 3) questionnaire length; 4) vacant addresses; 5) some people's lack of willingness to cooperate with "officialdom".

¹¹Thus, if 12 respondents chose noise A as "most bothersome", 7 as "second-most bothersome," and 4 as "third-most bothersome", the weighted total would be $12 \times 3 + 7 \times 2 + 4 \times 1 = 54$. The sum of the totals for each of the sources provided a grand total which, divided into the individual source totals yielded a percentage score for each source.

This weighting is somewhat arbitrary, and the reader should be aware of the impossibility of precisely quantifying subjective reactions, such as those to noise.

¹²U.S. Department of Housing and Urban Development, *Noise in Urban and Suburban Areas: Results of Field Studies*. Washington: U.S. Government Printing Office, 1967, p. 7.

¹³Fair Housing Committee. *Housing Viewpoint*. Davis: Associated Students, University of California, Davis. Published periodically.

¹⁴Although tabulation and analysis of the first questionnaire was accomplished by the present author, tabulation of the second questionnaire was done by Planning Division employee Helen Dinsdale, and preliminary analysis was undertaken by Edwin Bloomberg. Errors in calculation in the original have been corrected.

¹⁵Environmental Protection Agency, *op. cit.*, 6; Jacoby, *op. cit.*, 170, 173; John Chung Hwang and Kenneth William Hirsch. *Community Problems in the Lives of Sacramento Area Adults*. Project Report 1, Department of Communication Studies, California State University, Sacramento, (1975), 8-10. It is possible that Davis' survey sample had proportionately fewer student than family responses due to: 1) the high proportion of loud-music-induced hearing impairment among people 12 to 25 years of age; 2) students' lower propensity to return questionnaires due to other demands on their time and to lack of a long-term stake in the community.

¹⁶Jacoby, *op. cit.*, citing U.S. Department of Housing and Urban Development. *Noise in Urban and Suburban Areas: Results of Field Studies*. Washington: Government Printing Office, 1967; "What's most irritating," *The Seattle Times*, Dec. 26, 1976, p. A-14.

¹⁷*Noise Element: An Element of the Tulare County General Plan*. (Tulare): Tulare County Planning Department, 1975, 15; Jean Freitas. *San Joaquin County Council of Governments Noise Element*. (Stockton): San Joaquin County Council of Governments, 1974, H-2.

¹⁸*California Administrative Code*, Title 24, and City Ordinance 725 (Davis) adopt by reference Appendix Chapter 35 (on sound-transmission standards) of the *Uniform Building Code*, 1973 Edition. Whittier: International Conference of Building Officials, 1973, 642.

¹⁹*City of Davis General Plan* (revised). Davis: (Department of Community Development), 1977, 77.

