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RESPONSE TO URBAN SOUNDS IN RELATION TO THE RESIDENTS' CONNECTION WITH THE SOUND SOURCES

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ABSTRACT

A questionnaire survey was conducted in Kyoto City, Japan. In the study area are celebrated a big festival in summer which is famous for its parade of beautiful floats, some of which carry bands of peculiar festival music being recognised to be characteristic of the city. The description rates of the festival music for free response questionnaire asking about the sounds of religion and/or ceremony, of summer and characteristic of Kyoto were different between the community units with and without music band. The response to traffic noise is dependent on the positional relation between the listener of sound and the street. The facts suggest that the respondents' attitudes toward the sound source which are considered to be determined by the positional and mental relationships between the listeners and the sound sources are significant factors influencing the community reaction to environmental sounds.

1 - INTRODUCTION

Response to sound is related to the listener's mental, social and geographical connection with the sound source. This paper reports how residents living in a comparatively limited area in a city respond in different manners to the sounds depending upon their connection with the sources on the basis of the result of questionnaire survey undertaken in Kyoto, Japan.

2 - METHODS AND MATERIALS

2.1 - Study area

The study area is the commercial centre of the city of Kyoto where traditional houses and new buildings are mixed in a fairly limited area as wide as about 1 square kilometre. The was constructed as the capital of Japan in 794 imitating that of China with grid of streets as illustrated in Figure 1 in which the study area is shown. The city now holds one and half million of population and is taken as the cultural capital to be a tourist mecca. In the figure the arterial roads of the city are drawn in grey. The length of the side of a block is about 120 m. Most of the inhabitants in the area reside in traditional low houses densely built along streets or in alleyways some of which are blind alleys.

Figure 2 illustrates a prototype of a community unit in the area. The area was built up as a town about five hundred years ago when medieval citizens started to live in a small area surrounded by wall to protect themselves from invaders after the city was destroyed in a big war. The shape of community units in the study area is, as is shown in Figure 2, like a tortoise shell since each community formed along one block of the street. A community unit in the area holds about 25 to 70 households today, some of which are merchants or even small companies of Japanese costume for the most cases. Many of the families in the traditional houses live in the area for a long time, even for generations. There stand some higher buildings where new comers reside in an isolated manner from the community of the area. The area is famous for Gion Festival the inhabitants celebrate in July every year. It is one of the oldest and biggest festivals in Japan and its parade of 32 beautiful tall floats, ten of which carry bands of music performed by flutes, drums and small gongs, fascinates the citizens and the tourists. The floats are called "yama" or "hoko", depending upon the type of the float, thus the area is called "Yamahoko-cho," the

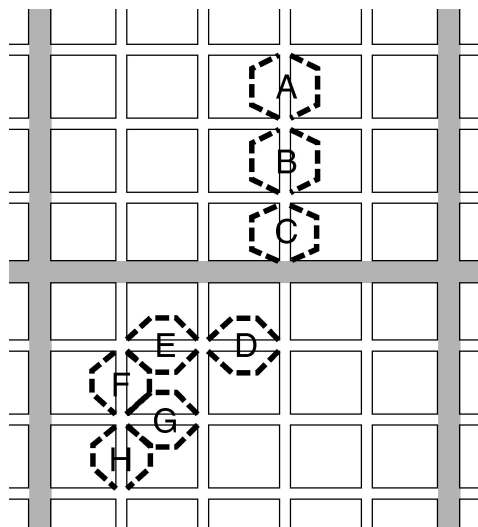


Figure 1: A map of the study area; the areas shown by broken lines of tortoise shell shape and indicated by alphabets are the community units where the present survey was undertaken.

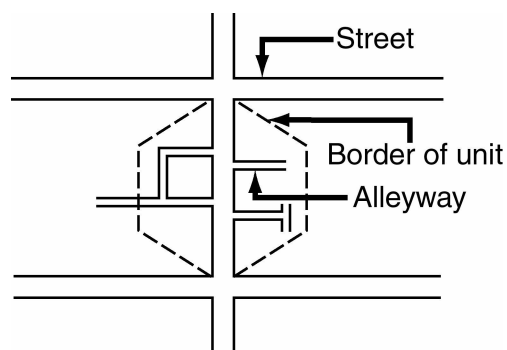


Figure 2: A prototype of the community units in the study area; the unit formed along a block of street containing a street and a few alleyways.

town of "yama" and "hoko". The music is no doubt the best known festival music as peculiar to Gion Festival to all over the country through the media of TV and radio and is taken characteristic of Kyoto's summer. The all the eight community units indicated by the capital letters from A to H in the map of Figure 1 belong to "Yamahoko-cho" and hold their own floats.

The soundscape of "Yamahoko-cho" changes drastically during the festival season. Traffic noise is the dominant sound on ordinary days in the area. But during the festival term lasting for about 3 weeks in July various festival sounds become dominant in the evening in the area. Particularly for five days after floats are constructed in the units car traffic is severely restricted so that there is no traffic noise and the units are filled with sounds of festival.

2.2 - Questionnaire survey

Questionnaire survey was conducted by means of leave-and-pick-up method. The number of the households in eight communities in the study area was 454 among which 267 households received the questionnaires and one of the members of each household who stay at home most answered the questions. The number of valid answers was 223.

The questionnaire consisted of 16 questions. In Table 1 are shown the questions and alternatives the answers of which are used for analysis in this paper.

Question A: "Which traffic do you find annoying, cars or motorbikes?"
<ul style="list-style-type: none"> • Cars are more annoying • Motorbikes are more annoying • Both are equally annoying • Neither is annoying
Question B: "Are you annoyed by the traffic when you are at home?"
<ul style="list-style-type: none"> • Yes, annoyed • No, not annoyed
Question C: "Is there a particular street traffic noise of cars and motorbikes from which annoys you? If any, please write the name of the street. And when is the time of a day?"
Question D: "Please write freely the sounds heard in your neighbourhood."
<ul style="list-style-type: none"> • Sounds of festivals and ceremonies • Sounds of summer • Sounds characteristic of Kyoto

Table 1: Questions and alternatives relevant to the present study.

3 - RESULTS

3.1 - Urban traffic noise

In Table 2 are tabulated the community response expressed in percentage to the traffic passing through the respondents' community unit. The response to Question A indicates that the majority of residents find the road traffic in their unit annoying. The residents living in the houses facing alley have stronger negative attitude towards motorbikes than those living in the houses facing street. It is presumably the reflection of the fact that the residents living along alleys enjoy fairly quiet environment because alleys are too narrow for cars to get into, but small motorbikes occasionally go through alleys and disturb the quiet. The residents of elevated flats also represent comparatively stronger negative attitude toward motorbikes, which is due to reckless driving mostly done in the weekend midnight in the arterial roads 200 to 300 m away from their flat. How much annoyed by traffic noise from the street penetrating the unit of the respondents depends above all on whether the house faces to a street or not. The attitude also differs whether the respondents live in smaller houses or larger houses. As the traditional large house in Kyoto has narrow frontage and long depth for historical reason of taxation, as shown in Figure 3, the living room of a large house is located in the deeper part of the house and residents do not hear much of the sounds from the outside. The residents living in the smaller houses facing street, on the other hand, having the same frontage with shorter depth hear the sounds from the outside very well. As a result the latter reports annoyed by traffic noise when they were at home more than the former.

Question	Alternative	Smaller house facing street	Larger house facing street	House facing alley	Elevated flat*
A	Car	41%	50%	26%	21%
	Motorbike	22%	16%	36%	38%
	Both	32%	29%	30%	29%
	Not annoyed	4%	8%	10%	6%
B	Annoyed	56%	39%	18%	47%
	Not annoyed	36%	53%	75%	47%

Table 2: Community response to the traffic passing through the respondents' unit (* flat in apartment house of tall building with over 5 floors).

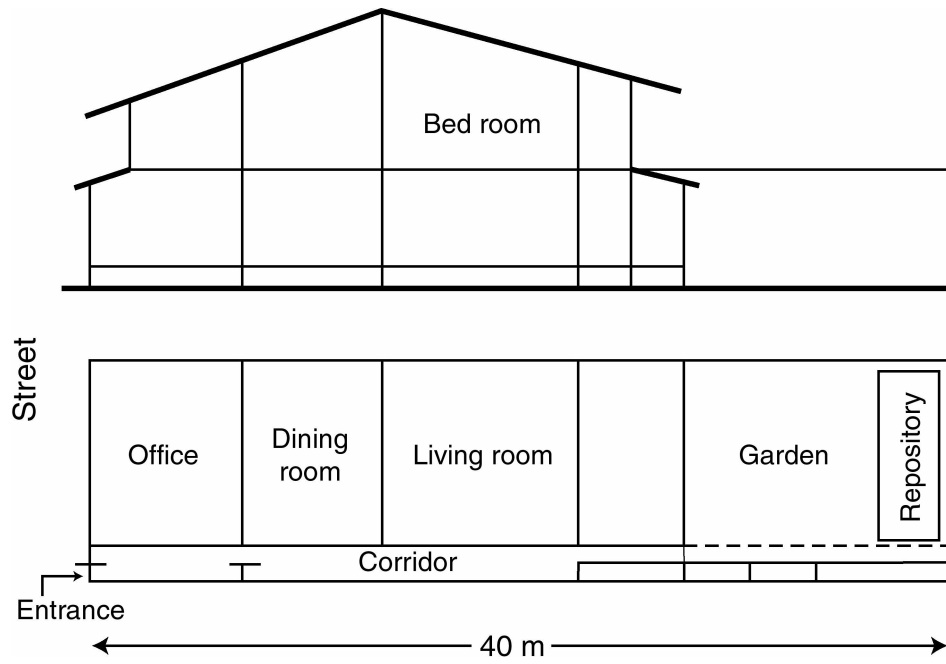


Figure 3: Plan and elevation of a typical large house in the study area. The depth of the house is about 40 m and width 5 to 10 m.

In Table 3 are shown the response on Question B asking about the street and time of a day where and when the respondents are annoyed by the traffic noise. In the daytime people living in both smaller and larger houses facing street are annoyed by the traffic noise of the street in the respondents' community unit by 45% and 47%, respectively. Although people living in the larger houses are slightly less annoyed than those living in the smaller houses by the traffic of the streets in their units in the nighttime, the responses are basically the same of the both residents in the smaller and larger houses. The residents living in larger houses report that they are annoyed by the traffic noise from arterial roads a little apart from their houses in the daytime and nighttime. They hear the noise of reckless driving in the nighttime from time to time. It is remarkable the response rate is as high as 22%, although the SPL of reckless driving noise is less than 60 dB in their houses which is much lower compared with over 80 dB at maximum of traffic noise in the street of their community unit. The residents in the houses facing alley also report annoyed by the traffic noise from arterial roads a little apart from their houses in the nighttime. These responses are partly explained by the positional relation between the listeners and the sound sources because the residents living in the larger houses and those facing alley stay in the deeper part of the block of the community unit particularly in the nighttime, and resultantly are not annoyed much by the traffic passing through the unit. The responses are also explained by the attitude toward sound source because the residents in the larger houses and houses facing alley hear in the comparatively quiet condition traffic noise from arterial roads which is audible though soft. The noise that annoys the residents is that of reckless driving occasionally reaching the respondents' houses in the nighttime. Thus it can be said that the high percentage might be attributed to the negative attitude toward the reckless driving.

Street	Smaller house facing street		Larger house facing street		House facing alley		Elevated flat	
	Day	Night	Day	Night	Day	Night	Day	Night
Street in the respondents' unit	45%	18%	47%	11%	59%	16%	3%	6%
Street in the neighbouring unit	16%	5%	8%	3%	6%	9%	21%	26%
Others (arterial road inclusive)	8%	7%	22%	22%	8%	17%	12%	41%

Table 3: Percent annoyed by the noise from different streets in the daytime and in the nighttime.

The response rate of the residents living in the houses facing alley annoyed by traffic noise is the highest to be 59%. This includes the response to motorbikes passing the alleys. Measurements of sound level in the area tell the sound levels in the alleys are about 10 to 20 dB lower than that in the streets. Thus the higher response rate of the residents of houses facing alley would be attributed to their attitude toward the traffic disturbing their comparatively quiet environment. The response of the residents living in the elevated flat is quite different from that of those living in the traditional houses. They are scarcely disturbed by the traffic noise in the vicinity but are by the traffic apart from the flat. Particularly in the nighttime they are annoyed by traffic noise from arterial roads which are located 200 to 300 m away from the flat. Their response can also be explained by the positional relation between the listeners and the sound sources as for the residents in the elevated flat the distances from sound sources do not make much difference between the sources in the community unit and those from the streets of neighbouring units and other roads and there are much less obstacles to reduce the level of sounds on the path of propagation.

3.2 - Festival music

Table 4 shows the rate of the respondents who write the festival music as the sounds of religion and/or ceremony, of summer and characteristic of Kyoto in their free answers to Question D. It should be noted that the community units from A to C have floats with music band but the rest of the units do not. When asked about the sounds of religion and/or ceremony a half of people living in the units with music band write festival music, while in the units without music one third of population do. In the case of the typical sound of summer heard in the area, the rate of description in the units without music band is one fourth on average. The festival music is considered to be characteristic of Kyoto by 72%, which is very high rate as a free response, of people in the units with music band. The rate is also high in the units without music band to be 54%. The average rate over units is 60% in the units with music bands and 37% in the units without music bands as is shown in the table. It would be possible to say that the difference of the response rates is the reflection of the difference in the attitude toward the festival music. For the residents in the unit with music bands the music is by all means their own sound. They hear it at home and are raised on the music from the age of infant in July every year during the first half of the month when the bands practice. Moreover most of the male residents have more or less experiences of attending the bands for the most cases in their teenage. It would not be an overstatement to say that the music is indelibly moulded in their hearts. The residents in the units without music bands have not such experiences although they attend the festival parade carrying their own floats. They may hear the music faintly at home or on the street near their units. The music is not the sound of their own but of their circle. Anyway one can see that the attitudes toward the festival music of the residents in the study area strongly influence their response when one sees the rates shown in Table 4 which are remarkably high compared with the rate, 7%, of the respondents who lived in another area of the city and wrote the festival music as the sound characteristic of Kyoto in the same kind of survey one of the present authors carried out.

Community unit	Community unit having float with music band				Community unit having float without music band					
	A	B	C	average	D	E	F	G	H	average
Religion	69%	58%	56%	49%	50%	13%	29%	43%	27%	33%
Summer	50%	52%	56%	52%	23%	33%	25%	27%	22%	25%
Kyoto	75%	71%	75%	72%	64%	54%	50%	50%	55%	54%
Average	57%	64%	59%		45%	33%	35%	40%	35%	
Average over units	60%				37%					

Table 4: Percentage of respondents who write the festival music as the sounds of religion and/or ceremony, of summer and characteristic of Kyoto

4 - CONCLUSIONS

A questionnaire survey was conducted in the central part of Kyoto City, Japan. From the responses to the questions asking about which traffic is annoying and the description rate in the free responses, it is concluded that the respondents' attitudes toward the sound source which are considered to be determined by the positional and mental relationships between the listeners and the sound sources are significant factors influencing the community reaction to environmental sounds.