

# Survey on vehicle horn use in urban areas of Korea

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### ABSTRACT

In previous studies, we carried out questionnaire surveys to investigate the current circumstances of vehicle horn use and the effects of horn use on drivers and pedestrians in Japan. Several cities in other countries face noise problems relating to the use of car and motorbike horns. Our survey design might help obtain information on the circumstances of vehicle horn use in such areas, which can subsequently be used to design countermeasures to reduce adverse effects. Therefore, we conducted a similar survey on horn use in South Korea. Measurement of noise at a crossroad with heavy traffic revealed more than 100 uses of the horn per hour. The questionnaire survey included questions on the latest or last-remembered case of horn use in various situations in which the respondent was a driver or pedestrian. It was found that many pedestrians had experiences of being honked at with a single honk, two short honks and a long honk. Such honking mostly aroused negative psychological reactions such as the respondent finding the horn use startling, noisy, or irritating. There were no significant relationships between questionnaire items of the driver's own horn use, suggesting there is no particular manner of the driver's own horn use.

Keywords: Vehicle horn, Timing pattern, Psychological reaction I-INCE Classification of Subjects Numbers: 11.9.2, 63.2

## 1. INTRODUCTION

In Japan, drivers frequently use their vehicle horn as a signal in various situations such as when passing each other; nevertheless, the Japanese Road Traffic Law states that a vehicle horn should be used only in an emergency or in dangerous locations (1). Such horn use might generate a noise problem in neighborhoods. Furthermore, drivers often honk at pedestrians and cyclists who are unaware of the driver's car approaching from behind. The sound level of a vehicle horn as measured in front of the vehicle is very high (i.e., 93–112 dB (2)), and potential adverse effects of the use of a vehicle horn on people outside the vehicle, such as pedestrians and cyclists, has thus been a concern. In our previous study, to investigate the issue concerning vehicle horn use described above, questionnaire surveys were carried out in Japan (3,4). The questionnaire results revealed that vehicle horns were frequently used by drivers to express gratitude or to gain another's attention. The previous survey also reported negative psychological impacts of vehicle horn use on not only drivers but also pedestrians.

Several cities in countries other than Japan face noise problems relating to the use of car and motorbike horns (5-7). In considering a countermeasure to reduce the adverse effects of vehicle horn use in such areas, it is necessary to investigate the current circumstance of vehicle horn use. A questionnaire survey similar to that used in the previous study in Japan (3,4) should be able to clarify the current circumstances of vehicle horn use in areas facing the issue described above.

In the present study, we carried out surveys similar to the survey we conducted in Japan in urban areas of South Korea and investigated their validity. First, in a preliminary survey, road traffic noise was measured at a crossroad with heavy traffic to grasp the current state of vehicle horn use. The

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noise measurements indicated frequent vehicle horn use at the site where noise measurements were made. We thus adopted a questionnaire survey on vehicle horn use similar to that previously used (3,4).

### 2. Noise measurements

### 2.1 Procedure

As the preliminary survey to clarify the current state of vehicle horn use, noise measurements were conducted at a crossroad with heavy traffic in Seoul, South Korea. For reasons such as those of safety and convenience in the noise measurement (e.g., the closeness to the cooperator's office) and the permission of police, a crossroad near the subway station in Seoul (Gangnam-gu office station; Nonhyeon-dong, Gangnam-gu, Seoul), at which roads with three lanes in each direction cross, was chosen as the site for noise measurement. At this site, measurements were made over two and half days in November. The noise level was continuously measured for 6 hours on the weekend (13:00–19:00 on Sunday) and 11 hours on two weekdays (8:00–19:00 on Monday and Tuesday). Data of the noise level and the road traffic noise including horn sounds were recorded using a sound-level meter (RION NL–52). The microphone was located 1.5 m above the ground at the edge of the road, and was directed towards the center of the crossroad. Times of vehicle horn use were also recorded during the noise measurement.

### 2.2 Results

Figure 1 shows the frequency of vehicle horn use in each time zone of each day. The frequency of vehicle horn use on one weekday (i.e., Tuesday) was higher than that on the other days. There were on average more than 100 uses of a vehicle horn per hour on Tuesday; mean frequencies of vehicle horn use on each day were 54 (Sunday), 68 (Monday) and 128 (Tuesday). Although further noise measurements may be needed, the present measurement results revealed that drivers often honked their horn at the crossroad. In South Korea, drivers are permitted to turn right at a crossroad even if the traffic light controlling traffic flow straight ahead is red. There were thus frequent cases that a driver who wanted to turn right at the crossroad had to wait behind another driver waiting for the light to turn green and honked his or her horn. Such traffic regulation seems to be one of the reasons that vehicle horns were frequently used at the crossroad of the surveyed site.

Distributions of the noise level of vehicle horn sounds in each time zone of the two weekdays are illustrated in Fig. 2. In this figure, the box plot indicates the 25th to 75th percentile range of noise level data. The thin and thick lines in the box plot correspond to the median and mean values of noise level data, respectively. Error bars above and below the box represent the 90th and 10th percentile values. Dots above the upper error bar and those below the lower error bar indicate outliers. Mean noise levels of vehicle horn sounds measured at the site were around 71 to 75 dB, although noise level data were widely distributed between 62 and 98 dB.



Figure 1 – Frequency of vehicle horn use in each time zone during the noise measurement



Figure 2 - Distribution of the noise level of vehicle horn sound recorded at the site for noise measurement

## 3. Questionnaire survey on vehicle horn use

### 3.1 Outline of survey

Noise measurements were made at a representative site at which vehicles horns are often used (i.e., a crossroad in an urban area of South Korea). To clarify the detailed circumstances of vehicle horn use including the effects of vehicle horn use on people, a questionnaire survey on vehicle horn use was carried out.

A questionnaire form similar to that used in our previous study (3,4) was employed. The main questions related to the use of vehicle horns. Respondents were asked about the latest or last-remembered case of (I) their own horn use and (II) their experiences of being honked at by another driver in various situations when driving. They were also asked about (III) their experiences of being honked at by the driver of a car when they were a pedestrian (i.e., while walking). With regards to (I) a driver's own horn use and (II) a driver's experience of being honked at by another driver, the questionnaire sought details such as the time, place, traffic volume, aim of horn use, and timing pattern of the horn honking. Moreover, respondents were asked about the target of their horn use and their psychological reactions when honked at by another driver. With regards to (III) a pedestrian's experience of being honked at by a driver, respondents were asked about the driver's reason for using the horn, the timing pattern of horn honking, and their psychological reaction to the honking.

The questionnaire also included questions similar to those in the form proposed by the ASJ for a social survey of noise problems (8), such as the question concerning sounds that the respondent hears in their daily lives at home and their responses to the sounds (i.e., whether they found a sound to be annoying), and their personal attributes (e.g., age, gender and occupation). Concerning sounds heard at home, the questionnaire included questions on the nature of the annoyance felt by respondents in response to hearing a vehicle's horn, the time when the respondents heard a vehicle's horn and the respondents' coping behaviors. For almost all questions, respondents selected one of multiple

possible choices, as listed in Tables 1 and 2.

The questionnaire survey was carried out in two cities of South Korea, Seoul and Busan, which are respectively the capital and second-largest city of South Korea. In the surveys of both cities, questionnaire forms were distributed to participants by cooperators of the present study. We obtained questionnaire answers from 123 participants living in Seoul and its suburbs, and 57 participants living in Busan. Participants were asked to fill out the questionnaire at home. Our cooperators received the filled-in questionnaire forms from participants after an interval of around 2 to 5 weeks. After eliminating blank forms submitted by two participants in Busan, the responses of 178 participants were analyzed. Although the manner of vehicle horn use might be different in the two surveyed areas, all of the responses were analyzed together in the following analysis because the number of responses was not sufficient to discuss vehicle horn use in each area separately.

Rates of responses concerning personal attributes are presented in Table 1. One hundred and two males and 76 females (57.3% and 42.7% of the total of 178 respondents, respectively) in their teens to seventies participated. Respondents mainly comprised salaried workers and students.

	Category	Number of responses	Rate of responses (%)
Gender	male	102	57.3
	female	76	42.7
Age	teens	2	1.1
	twenties	85	47.8
	thirties	34	19.1
	forties	36	20.2
	fifties	17	9.6
	sixties	2	1.1
	seventies	2	1.1
	eighties and over	0	0
	no answer	0	0
Occupation	self-employed person	12	6.7
	salaried worker	65	36.5
	independent professional	6	3.4
	full-time housewife	10	5.6
	part-time worker	0	0.0
	student	74	41.6
	person without a regular occupation	2	1.1
	other	8	4.5
	no answer	1	0.6

Table 1 – Numbers and rates of responses (%) by personal attributes

### 3.2 Results

Table 2 presents the simply totaled results concerning vehicle horn use. There were 98 drivers among the respondents. Of these drivers, 89 recalled using their horn while driving (Group I, driver's own horn use). Additionally, 85 drivers had experiences of being honked at by another driver (Group II, driver's experience of being honked at). Moreover, 91 of the respondents recalled being honked at while walking (Group III, pedestrian's experience of being honked at). There were far more respondents who recalled being honked at while walking (91 respondents) than respondents who recalled they had honked at people other than drivers in Group I (the sum of "cyclist" and "pedestrian" is 19.1% in response to the question of "target of horn use").

In terms of the reason for horn use ("aim of horn use"), more than half of the 89 drivers in Group I themselves had honked to gain another's attention and to alert another to danger while driving ("to gain another's attention": 22.5% of Group I; "to inform of danger": 46.1% of Group I). Moreover, many drivers had experienced being honked at for similar purposes ("to gain another's attention": 30.6% of Group II; "to inform of danger": 28.2% of Group II).

There were a few drivers who themselves had used their vehicle horn to express gratitude and had experiences of being honked at for a similar purpose (4.5% of Group I and 3.5% of Group II). Although many cases that drivers themselves honked their horn to express gratitude were reported in Japan (3,4), the present results suggest that similar horn use is not common among drivers in the surveyed areas. There were more than a few cases in which drivers themselves had used their vehicle

horn to vent anger and drivers had experiences of being honked at by another driver for a similar reason ("to vent anger":11.2% of Group I, and 14.1% of Group II).

Many pedestrians had experienced being honked at by a driver to alert them to danger and to gain their attention or to vent anger (i.e., "to inform of danger": 49.5%, "to gain another's attention": 17.6%, and "to vent anger": 16.5% of Group III).

With respect to the types of horn honking, a single honk or two short honks (onomatopoeically represented by "puQ" and "puQ puQ," respectively) were more frequently used than long honks (represented by onomatopoeic representations such as "puuu" and "puuu puuu"); a single honk and two short honks: 52.8% and 23.6% of Group I, 29.4% and 37.6% of Group II, 29.7% and 38.5% of Group III; a long honk and two long honks: 18.0% and 1.1% of Group I, 22.4% and 2.4% of Group II, 23.1% and 1.1% of Group III, respectively. The present survey reveals that there were many cases that pedestrians were honked at with long honks by drivers and that the types of horn honking for drivers and pedestrians in the present surveyed areas were similar to those in Japan (3,4).

Regarding the psychological reaction when honked at by a driver, there were more than a few drivers and pedestrians who had no particular feeling ("no particular feeling": 16.5% of Group II, 14.3% of Group III). However, pedestrians more frequently had negative psychological reactions; e.g., they considered the horn use to be startling, noisy, or irritating more often than drivers (the sum of the three items "startled," "sensation of noisiness," and "irritated": 48.2% of Group II and 75.8% of Group III), as shown in Table 2.

Questionnaire items		Rate of respondents (%)		
		Group I	Group II	Group III
		(89 respondents)	(85 respondents)	(91 respondents)
Target of horn use	car	73.0	—	_
	motorcycle	2.2		
	cyclist	1.1	—	_
	pedestrian	18.0	—	_
	other	3.4	—	—
	no answer	2.2		
Aim of horn use	to express gratitude	4.5	3.5	1.1
	to gain another's attention	22.5	30.6	17.6
	to inform of danger	46.1	28.2	49.5
	to vent anger	11.2	14.1	16.5
	incomprehensible	_	15.3	11.0
	other reasons	4.5	5.9	4.4
	no answer	11.2	2.4	0.0
Timing pattern of horn honking	a single honk	52.8	29.4	29.7
	two short honks	23.6	37.6	38.5
	three or more short honks	1.1	4.7	6.6
	a long honk	18.0	22.4	23.1
	two long honks	1.1	2.4	1.1
	three or more long honks	2.2	3.5	0.0
	other	0.0	0.0	1.1
	no answer	1.1	0.0	0.0
Psychological reaction when honked at	no particular feeling	_	16.5	14.3
	startled		23.5	37.4
	sensation of noisiness	_	15.3	18.7
	irritated	_	9.4	19.8
	feeling sorry for blocking another driver's way	—	34.1	8.8
	comfortable		0.0	0.0
	other		1.2	1.1
	no answer		0.0	0.0

Table 2 – Rates of responses (%) for questionnaire items in each respondent group (—: no question)

# 4. DISCUSSION

### 4.1 Manner of a driver's own horn use

The previous survey conducted in Japan indicated significant relationships between the manner of a driver's vehicle horn use and various factors such as traffic conditions and the driver's intention (3). For instance, a single honk or two short honks were frequently used to express gratitude and to gain another's attention. Furthermore, while a long honk was sometimes used to alert another to danger or to gain another's attention, it was never used to express gratitude. In the present survey, to discuss similar relationships between questionnaire items concerning vehicle horn use, the questionnaire results were cross tabulated between two variables. Statistical testing using Cramer's V (9), a statistic measuring the strength of association between nominal variables, was conducted to examine the significant relationships.

As a result, no significant relationships between questionnaire items relating to the driver's own horn use were found at p < 0.05. Accordingly, the present statistical testing seems to suggest that there is no particular manner of horn honking (for instance, short honks to express gratitude and to gain another's attention, which were frequently reported in the previous surveys (3,4)). However, the cross tabulation should provide the current circumstances concerning the driver's own horn use. Therefore, the following results of cross tabulation were discussed.

Figures 3 to 6 illustrated relationships between the place of horn use and the timing pattern of horn use (Fig. 3), between the target of horn use and the timing pattern of horn use (Fig.4), between the driver's aim of horn use and the timing pattern of horn use (Fig.5), and between the target of horn use and the driver's aim of horn use (Fig.6).

According to Fig. 3, a single honk was equally often used in various places such as narrow lanes, two-lane roads, and main roads. However, although two short honks and a long honk were mainly used on wide roads such as two-lane or main roads, such cases were less frequent than those of a single honk. Figure 5 shows that a single honk or two short honks were frequently used to alert another to danger and to gain another's attention. In Japan, such horn use was also employed to express gratitude. A driver's horn use for a similar reason was rarely found in the present survey. The horn use to express gratitude may not be widely adopted among drivers. A long honk was sometimes used not only to alert another to danger but also to vent anger.







Figure 4 – Relationship between the target of horn use and the timing pattern of horn use (V = 0.220, ns).

According to Figs. 4 and 6, drivers stated that they frequently honked at another driver with short honks (i.e., a single honk or two short honks) or a long honk for the purpose of not only alerting them to danger and gaining their attention but also venting anger. Furthermore, drivers occasionally honked at pedestrians with short honks to alert them to danger, even though they mainly directed their own horn use toward cars.



Figure 5 – Relationship between the driver's aim of horn use and the timing pattern of horn use

(V = 0.245, ns).



Figure 6 – Relationship between the target of horn use and the driver's aim of horn use (V = 0.295, ns).

### 4.2 Effects of vehicle horn use on the driver's and pedestrian's psychological reactions

The type of horn honking and another driver's intention of horn use should arouse various psychological reactions in those hearing the horn (i.e., other drivers and pedestrians). Because pedestrians are generally exposed to a vehicle horn sound at a high sound pressure level, they may have negative psychological reactions. Therefore, to investigate the effects of vehicle horn use on a driver's and pedestrian's psychological reactions, relationships between the questionnaire items, such as that between another driver's aim of horn use and a driver's or pedestrian's psychological reactions, were analyzed by cross tabulation between variables. In the same manner as for the cross tabulated results concerning the driver's own horn use mentioned above, statistical testing using Cramer's V was carried out to find the significant effects of vehicle horn use.

### 4.2.1 Driver's psychological reactions to another driver's vehicle horn use

As a result of cross tabulation of the driver's psychological reactions, no significant relationships were found at p < 0.05. However, results of cross tabulation should provide the actual effects of another driver's vehicle horn use on the driver's psychological reactions.

Figure 7 shows the relationship between another driver's aim of horn use, as guessed by the respondent (i.e., driver), and the respondent's psychological reaction when honked at. Drivers had mainly been honked at by another driver to gain their attention and to alert them to danger. Such horn use aroused various psychological reactions such as no particular feeling, feeling startled and feeling sorry for blocking another driver's way. The absence of significant statistical results

(according to Cramer's V) suggested that there is no particular tendency in Fig. 7.

Figure 8 illustrates the relationship between the timing pattern of horn honking and the respondent's psychological reaction when honked at, which was also not statistically significant. Short honks such as a single honk and two short honks aroused driver's psychological reactions such as no particular feeling and feeling sorry for blocking another driver's way as well as negative psychological reactions (i.e., feeling startled, having a sensation of noisiness and feeling irritated). Similar reactions were induced by a long honk.

The present results concerning driver's psychological reactions and the results of the driver's own horn use presented in the previous section may suggest that there is no definite manner of the driver's vehicle horn use, and thus, the vehicle horn is not used in communication between drivers. In Japan, drivers frequently use their vehicle horn to communicate with other drivers; e.g., when a driver briefly honks after being given the right of way by another driver on a narrow road (3,4). Such vehicle horn use was rarely found in the present survey.



Figure 7 – Relationship between another driver's aim of horn use, as guessed by the respondent (i.e., driver), and the respondent's psychological reaction when honked at (V = 0.271, ns)



Figure 8 – Relationship between the timing pattern of horn honking and the respondent's (i.e., driver's) psychological reaction when honked at (V = 0.257, ns)

#### 4.2.2 Pedestrian's psychological reactions to vehicle horn use

Regarding the pedestrian's psychological reactions, significant effects of a driver's horn use directed toward pedestrians were found at p < 0.05.

The significant relationship between the driver's aim of horn use, as guessed by the respondent (i.e., pedestrian), and the respondent's psychological reaction when honked at is presented in Fig. 9. Although vehicle horn use to alert pedestrians to danger aroused various psychological reactions, they prominently reported that such horn use startled them. A driver's horn use to vent anger mostly aroused negative psychological reactions such as a feeling that the horn use was startling, noisy, or irritating.

Figure 10 illustrates the significant relationship between the timing pattern of horn honking and the respondent's psychological reaction when honked at. Short honks such as a single honk and two short honks aroused various psychological reactions in pedestrians. According to both Figs. 9 and 10, although there were some cases that short honks used to gain a pedestrian's attention and to alert

them to danger induced no particular feeling, many cases in which pedestrians were startled by short honks intended to alert them to danger were also reported. A long honk aroused negative psychological reactions in pedestrians for any purpose of horn use.

The finding that pedestrians were negatively affected by vehicle horn use was similar to that for Japan (3,4). According to the comparison of the present results concerning the pedestrian's and driver's psychological reactions to vehicle horn use (see Figs. 7 to 10) and the simply totaled results (see Table 2), vehicle horn use aroused negative psychological reactions much more in pedestrians than in drivers. A likely reason is the difference in sound level of a horn sound inside and outside a vehicle. Pedestrians are generally exposed to a horn sound that is approximately 40 dB higher than the sound heard by a driver inside a vehicle (10). Drivers should be aware that the use of the vehicle horn directed at pedestrians will generate adverse psychological reactions.



Figure 9 – Relationship between the driver's aim of horn use, as guessed by the respondent (i.e., pedestrian), and the respondent's psychological reaction when honked at (V = 0.363, p < 0.05)



Figure 10 – Relationship between the timing pattern of horn honking and the respondent's (i.e.,

pedestrian's) psychological reaction when honked at (V = 0.301, p < 0.05)

## 5. CONCLUSIONS

The measurement of noise at a crossroad in Seoul, South Korea, revealed frequent horn use, although there were differences in frequency depending on the day of measurement. Mean noise levels of vehicle horn sounds measured at the site were around 71 to 75 dB.

The questionnaire survey concerning the latest or last-remembered instance of a driver's own horn use and their experiences of being honked at by another driver when driving revealed that the respondents frequently honked at another driver with short honks or a long honk not only to alert them to danger and to gain their attention but also to vent anger. Few drivers used their horn to express gratitude, while such horn use was widely adopted among drivers in Japan (3,4). Furthermore, another driver's horn use to gain their attention and to alert them to danger aroused various psychological reactions such as no particular feeling, feeling startled and feeling sorry for blocking another driver's use of the vehicle horn, suggesting that there may be no definite manner of a driver's vehicle horn use. The present results suggest that the vehicle horn is not used in communicating with other drivers.

Significant negative effects of a driver's vehicle horn use on pedestrians were found. There were many reports of a horn being used to alert pedestrians to danger and short honks, such as a single honk and two short honks, startling pedestrians. A long honk aroused solely negative psychological reactions in pedestrians.

The current circumstances of vehicle horn use in the surveyed areas were partly revealed in the present study. However, further noise measurements of vehicle horn sound and questionnaire surveys of people with various attributes and living in various areas are needed to clarify general tendencies and regional differences in vehicle horn use.

The present questionnaire form also included questions on the respondent's awareness of their own horn use; e.g., a question concerning the respondent's attitude toward vehicle horn use, questions concerning the respondent's norm consciousness of vehicle horn use, a question concerning the ease or difficulty of vehicle horn use, and a question on the respondent's ethical viewpoint. In our future work, the effects of intrinsic factors of drivers such as attitude, personal norm and moral obligation relating to their own horn use, as evaluated by responses to the above-mentioned questions, will be investigated.

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