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## Questionnaire survey on vehicle horn use

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The Japanese Road Traffic Law provides that a vehicle horn should be utilized in dangerous situations or at places where a horn sign has been installed. However, drivers also frequently use their vehicle's horn as a signal in the situations when they pass each other. As such, the above-mentioned law is likely to become a law in name only. Therefore, a questionnaire survey was carried out to ascertain the current circumstances of vehicle horn usage. Respondents were asked the latest or last remembered instance of horn use in various situations, both when they were driving and also when they were pedestrians. With regards to experiences of being tooted at by another driver, the questionnaire included questions concerning place, traffic volume, the aim of horn use, timing pattern of horn tooting, the respondent's mental reaction when tooted at by another driver, etc. As a result, drivers were found to mostly have had negative mental reactions when the subject of long toots. Pedestrians' negative mental reactions were mainly aroused by horn use to gain another's attention or to inform of danger. Furthermore, over 40 percent of non-drivers were displeased with the volume and the sound quality of horns.

## 1 Introduction

In Japan, the Safety Standard for Road Transportation Vehicle standardizes noise levels (i.e., A-weighted SPL) for a vehicle's horn as measured in front of the vehicle; 93–112 dB [1]. However, Hashimoto reported that listeners were startled by vehicle's horns even at the lower limit noise level provided by the Safety Standard [2]. As well, the Japanese Road Traffic Law provides that a vehicle's horn should be utilized only in a dangerous place with a signpost indicating horn use, such as on a blind curve [3]. In Japan, however, drivers frequently use their vehicle's horn to communicate with other drivers; for example, in situations when they pass each other. Drivers also often toot at pedestrians who are unaware of a car approaching from behind. Such uses are against the above-mentioned law. Given this reality, the law is likely to become a law in name only. Thus it probably needs to be reconsidered. As noted above, there are some problems with vehicle horns. Therefore, the present study carried out a questionnaire survey to ascertain the current circumstances of vehicle horn usage.

## 2 Outline of the survey

The format for the social survey noise problems proposed by the Acoustical Society of Japan [4] was modified in the present survey. This format comprised questions related to satisfaction with the sound sources that the respondents heard in their daily living environment, questions about vehicle horns and personal attributes (age, gender, occupation, family structure, etc). In the main questions regarding vehicle's horn, respondents were asked the latest or last remembered instance of (1) their own horn uses and (2) their experiences of being tooted at by another driver in various situations when driving. They were also asked; (3) their experiences of being tooted at by a car driver when they were pedestrians (i.e., while walking). With regards to (1) a driver's horn use and (2) a driver's experience of being tooted at by another driver, the questionnaire sought details of time, place, traffic volume, the aim of horn use, timing pattern of horn tooting, etc. Moreover, respondents were also asked their mental reactions when tooted at by another driver. With regards to (3) a pedestrian's experience of being tooted at by a car driver, respondents were asked the driver's aim for the horn use, timing pattern of horn tooting and their mental reactions induced by being tooted at.

Questions related to the volume and sound quality of a vehicle's horn were also contained in the questionnaire.

The questionnaire survey was conducted at a venue near a railway station. People passing-by in front of the venue were requested to participate. We also recruited some participants from our university, and asked them to fill out the questionnaire at home. Ninety-six males and 111 females (total 207 respondents) aged from their teens to seventies participated in the questionnaire survey. This survey was conducted between October 2006 and January 2007.

## 3 Results

There were 140 drivers among the respondents. Of these drivers, 114 had used a horn while driving (Group (1), driver's horn use). One hundred and twenty drivers had experienced being tooted at by another driver (Group (2), driver's experience of being tooted at). Moreover, 130 out of all respondents had an experience of being tooted at while walking (Group (3), pedestrian's experience of being tooted at).

Table 1 shows in part the questionnaire results. In Table 1, half of the 114 drivers in Group (1) who themselves had used a horn while driving tooted their vehicle's horn for the purpose of gaining another's attention. There were also drivers who had used their vehicle's horn to express gratitude (23.7% of Group (1)). Moreover, many drivers also had experiences of being tooted at for the same purpose ("to gain another's attention": 40.0 % of Group (2); "to express gratitude": 30.0 % of Group (2)). Horn use to express gratitude can be frequently found in situations where drivers yield the right of way in Japan, although the Japanese Road Traffic Law provides that the vehicle's horn should be primarily used to avoid danger or used in places where horn signs are installed [3].

On the other hand, there are many pedestrians who responded that they had experiences of being tooted at by a car driver to gain their attention (54.6 % of Group (3)) or to inform of danger (20.8 % of Group (3)), as shown in Table 1.

With respect to the timing pattern of horn tooting (not shown in Table 1), a single toot or two short toots (onomatopoeically represented by "puQ" and "puQ puQ", respectively) were more frequently used than long toots; a single toot and two short toots: 44.7% and 34.2% of Group (1), 39.2% and 25.8% of Group (2), 26.9% and 26.2% of Group (3); a long toot and two long toots: 14.9% and 2.6%

Items	(1) Driver's horn use (114 respondents)		(2) Driver's experience of being tooted at (120 respondents)		(3) Pedestrian's experience of being tooted at (130 respondents)		
Aim	to express gratitude	27	23.7%	36	30.0%	4	3.1%
	to gain another's attention	57	50.0%	48	40.0%	71	54.6%
	to inform of danger	23	20.2%	15	12.5%	27	20.8%
	to vent anger	3	2.6%	9	7.5%	7	5.4%
	incomprehensible	---	---	8	6.7%	20	15.4%
	other reasons	3	2.6%	1	0.8%	0	0.0%
	no answer	1	0.9%	3	2.5%	1	0.8%
Mental reaction by being given the horn	no special feeling	---	---	40	33.3%	23	17.7%
	startled	---	---	22	18.3%	43	33.1%
	noisy	---	---	8	6.7%	14	10.8%
	irritating	---	---	13	10.8%	21	16.2%
	feeling sorry for blocking another driver's way	---	---	27	22.5%	22	16.9%
	others	---	---	7	5.8%	3	2.3%
	no answer	---	---	3	2.5%	4	3.1%

Table 1 Numbers of respondents and corresponding percentages for questionnaire items in the questions concerning the aim of horn use and mental reaction (---: No question)

Items	Driver (140 respondents)		Non- driver (67 respondents)		
Volume	too loud	5	3.6%	2	3.0%
	fairly loud	50	35.7%	30	44.8%
	moderate	81	57.9%	34	50.7%
	fairly low	3	2.1%	0	0.0%
	too low	0	0.0%	0	0.0%
	no answer	1	0.7%	1	1.5%
Sound quality	good	13	9.3%	2	3.0%
	unpleasant	44	31.4%	28	41.8%
	insufficient	0	0.0%	0	0.0%
	neither good nor bad	45	32.1%	20	29.9%
	indifferent	26	18.6%	16	23.9%
	others	7	5.0%	1	1.5%
	no answer	5	3.6%	0	0.0%

Table 2 Numbers of respondents and corresponding percentages for questionnaire items concerning volume and sound quality of a vehicle's horn

of Group (1), 13.3% and 10.0% of Group (2), 27.7% and 9.2% of Group (3).

Furthermore, in other questions (not shown in Table 1), the number of responses of "daytime" in the time zone items, those of "a narrow lane" or "two-lane road" in the place items, and those of "respondent's and another driver's car only" or "a few cars in front and behind" in the traffic volume items were great, respectively ("daytime" in the time zone items: 62.3% of Group (1), 60.8% of Group (2); "a narrow lane" or "two-lane road" in the place items: 33.3% and 24.6% of Group (1), 25.8% and 30.8% of Group (2); "respondent's and another driver's car only" or "a few

cars in front and behind" in the traffic volume items: 41.2% and 38.6% of Group (1), 30.8% and 36.7% of Group (2)).

In terms of the psychological response evoked by a vehicle's horn, the largest number of responses was of "no special feeling" for drivers (33.3% of Group (2)). However, pedestrians with a similar reaction were not so many (17.7% of Group (3)). On the other hand, pedestrians had negative mental reactions (the sum of three items: "startled, noisy, and irritating") more than did drivers (43 respondents, 35.8% of Group (2); 78 respondents, 60.0% of Group (3)), as shown in Table 1.

Table 2 shows a tabulation concerning the volume and the sound quality of a vehicle's horn for drivers and non-

drivers. For more than half of the drivers and non-drivers, the volume of a vehicle's horn was moderate, and its sound quality was neither good nor bad, or not an object of concern. However, nearly 30–50% of drivers and non-drivers were discontented with the volume (the sum of respondents of "too loud" and "fairly loud": 39.3% of drivers, 47.8% of non-drivers) and the sound quality of a vehicle's horn (respondents of "unpleasant": 31.4% of drivers, 41.8% of non-drivers).

## 4 Discussion

### 4.1 Cross tabulation

To discuss the relationships between the questionnaire items (for example, traffic conditions and horn tooting, and a driver's or pedestrian's mental reaction and horn tooting) in each of the drivers' and pedestrians' experiences, the results of the questionnaire were cross tabulated. Statistical testing using Cramer's  $V$ , a statistical measure of nominal association, was done to discuss the relationship between the questionnaire items. The following relationships were found to be statistically significant in Groups (1) to (3).

#### (1) Driver's horn use

- Place and timing pattern of horn tooting:  $V=0.369$  (Fig. 1)
- Aim of horn use and timing pattern of horn tooting:  $V=0.336$  (Fig. 2)

Figures 1 and 2 show significant relationships between the place of the horn usage and the timing pattern of the tooting ( $V=0.369$ ,  $p<0.05$ ), and between the driver's aim of horn

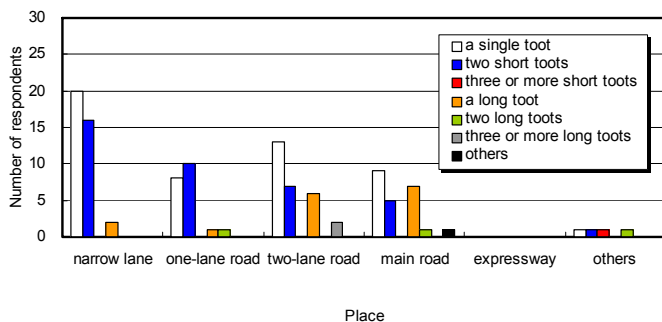


Fig. 1 Relationship between the place of horn use and the timing pattern of the tooting

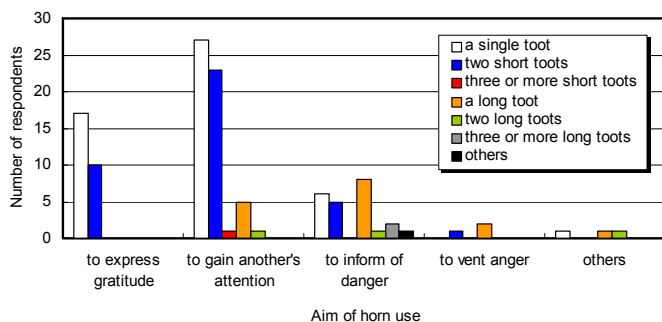


Fig. 2 Relationship between the driver's aim of horn use and the timing pattern of the tooting

use and the timing pattern of the tooting ( $V=0.336$ ,  $p<0.05$ ), respectively.

From Fig. 1, a single toot or two short toots were often used in various places, from narrow lanes to main roads. On the other hand, a long toot was rarely used in narrower roads, but was used in wider ones such as a two-lane or main road.

From Fig. 2, a single toot or two short toots were frequently used to express gratitude for the right of way being yielded by another driver, and to gain another's attention. A long toot was never used to express gratitude; however, it was sometimes used to inform of danger or to gain another's attention.

From these results, in various places, drivers briefly tooted their horn to express gratitude, or to gain another's attention. On the other hand, they tooted longer to gain another driver's attention, or to inform of danger in a wide road, such as a main road.

#### (2) Driver's experience of being tooted at

- Another driver's aim of horn use and timing pattern of horn tooting:  $V=0.362$  (Fig. 3)
- Another driver's aim of horn use and the respondent's (driver's) mental reaction when tooted at:  $V=0.379$  (Fig. 4)
- Timing pattern of horn tooting and the respondent's (driver's) mental reaction when tooted at:  $V=0.331$  (Fig. 5)
- Place and the respondent's (driver's) mental reaction when tooted at:  $V=0.298$  (Fig. 6)
- Traffic volume and the respondent's (driver's) mental reaction when tooted at:  $V=0.312$  (Fig. 7)

Figure 3 illustrates the significant relationship between another driver's aim of horn use, as guessed by the respondents, and the timing pattern of the horn tooting ( $V=0.362$ ,  $p<0.05$ ). When short toots were used, drivers mainly interpreted the horn as for expressing gratitude or to gain their attention. On the other hand, a long toot was interpreted as seeking to gain their attention or to inform of danger. These interpretations are similar to their own horn use, as shown in Fig. 2.

There were a small number of respondents (drivers) who did not comprehend another driver's aim of horn use when tooted at (6.7% of 120 drivers in Group (2)), as shown in Fig. 3 and also Table 1. It can, therefore, be said that the majority of drivers could understand the other driver's intention of horn use. The following relationship can thus be discussed.

Figure 4 shows the significant relationship between another driver's aim of horn use, as guessed by the respondents (drivers), and the respondent's mental reaction when tooted at ( $V=0.379$ ,  $p<0.05$ ). When drivers interpreted another driver's horn use as expressing gratitude, many of them said it had no special feeling. On the other hand, there were more drivers with negative mental reactions, such as startled, noisy and irritating for horn usage to gain another's attention (total 21 drivers) than respondents with similar reactions to other aims.

Furthermore, the significant relationship between the timing pattern of the tooting and the respondent's (driver's) mental reaction when tooted at is also shown in Fig. 5 ( $V=0.331$ ,  $p<0.05$ ). From Fig. 5, drivers mainly had no special feeling or felt sorry for blocking another driver's way when tooted

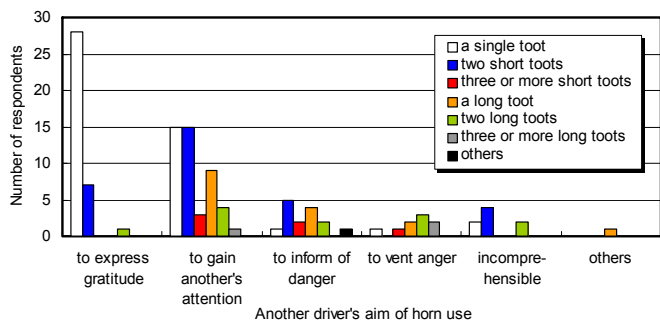


Fig. 3 Relationship between another driver's aim of horn use and timing pattern of the tooting

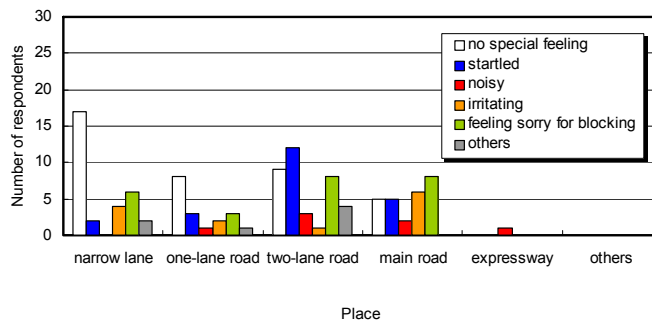


Fig. 6 Relationship between the place and a driver's mental reaction when tooted at

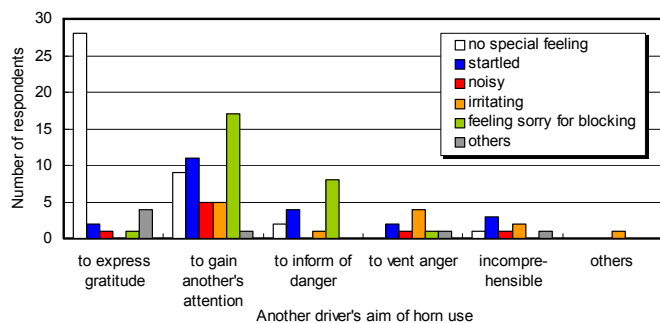


Fig. 4 Relationship between another driver's aim of horn use and a driver's mental reaction when tooted at

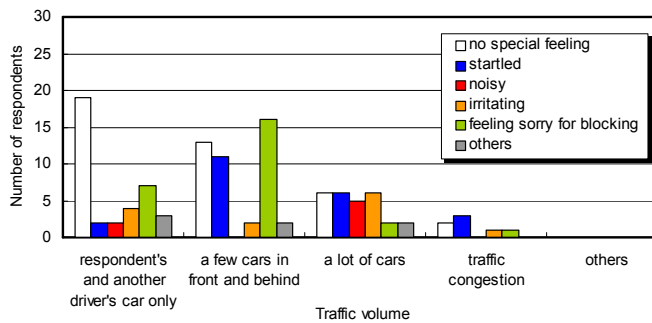


Fig. 7 Relationship between traffic volume and a driver's mental reaction when tooted at

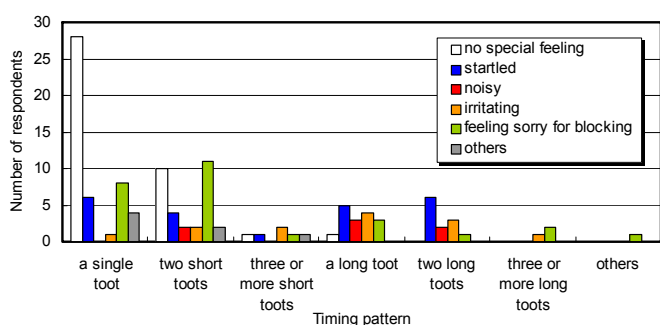


Fig. 5 Relationship between the timing pattern of tooting and a driver's mental reaction when tooted at

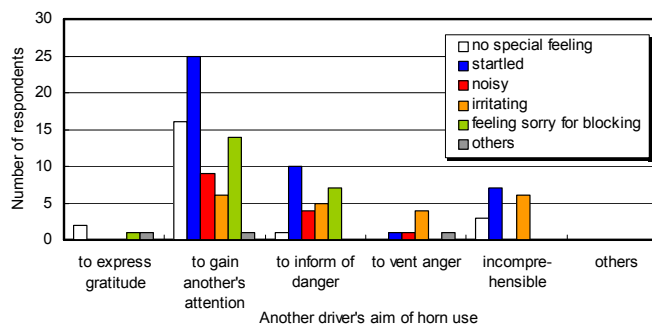


Fig. 8 Relationship between another driver's aim of horn use and a pedestrian's mental reaction when tooted at

with a single toot or two short toots. However, long toots such as a long toot and two long toots mostly aroused negative mental reactions such as startled, noisy, and irritating in respondents.

A driver's mental reaction when tooted at may also be affected by traffic condition. Figures 6 and 7 show the relationship between the place and the respondent's (driver's) mental reaction when tooted at, and that between the traffic volume and the respondent's mental reaction, respectively. These figures suggested that, in a narrow road with light traffic, such as a narrow lane and a one-lane road, another driver's horn use often induced no special feeling, but more frequently startled or irritated respondents when used in a wider road such as two-lane or main road with heavier traffic than in other places.

(3) Pedestrian experiences of being tooted at

- Another driver's aim of horn use and the respondent's (pedestrian's) mental reaction when tooted at:  $V=0.306$  (Fig. 8)

Figure 8 illustrates the significant relationship between another driver's aim of horn use, as guessed by respondents (pedestrians), and their mental reaction when tooted at. From Fig. 8, it can be seen that pedestrians mainly interpreted horn use as for gaining their attention or to inform of danger ("to gain another's attention to something": 54.6% of 130 respondents in Group (3), "to inform of danger": 20.8% of Group (3)). Horn use to gain another's attention and to inform of danger frequently aroused negative mental reactions such as startled, noisy and irritating in pedestrians; as well as "no special feeling" and "feeling sorry for blocking another driver's way". Pedestrians who had not comprehended a driver's aim of horn use were greater in numbers than the drivers who did.

As detailed above in the psychoacoustical experiment using a vehicle horn, participants were startled by vehicle horns even at the lower noise level limit (that is, around 90 dB) of the Japanese Safety Standard [2]. The present survey also revealed that there were many cases where vehicle horns had startled pedestrians or were felt to be noisy.

## 4.2 The need to improve the volume and sound quality of vehicle horns

As Table 2 shows, nearly 30–50% of drivers and non-drivers were displeased with the volume and the sound quality of vehicle horns. Especially, the rate of the disaffected non-drivers, who responded that a vehicle's horn was "too loud", "fairly loud", or that its sound quality was "unpleasant", was larger than that of the disaffected drivers (the volume was "too loud" or "fairly loud": 39.3% of drivers, 47.8% of non-drivers; the sound quality was "unpleasant": 31.4% of drivers, 41.8% of non-drivers). Considering that those outside vehicles who heard a vehicle horn tooted at them had negative mental reactions, the way in which a vehicle's horn is used and its acoustical characteristics need reconsidering.

## 5 Conclusion

The present survey ascertained that vehicle horns were frequently used to express gratitude or to gain another's attention. These utilizations are against the Japanese Road Traffic Law, which prohibits horn use except at dangerous places with a signpost allowing horn use such as a blind curve [3]. Moreover, long toots and horn use to gain another's attention or to inform of danger often aroused negative mental reactions in listeners. There was a tendency for this to be strongly felt among pedestrians.

Furthermore, drivers briefly tooted in narrow road. Such uses were seen in situations where drivers expressed thanks for being yielded the right of way by another driver. Accordingly, in neighbourhoods with narrow roads where a driver needs to give way to another driver, the residents living around there may be continually annoyed by frequent horn tooting. In the questions concerning sound sources heard by the respondents at home in their daily lives, 161 respondents had experienced noise from vehicle horns and 31 respondents were actually annoyed by the use. As detailed above, although vehicle horns have been employed as a means of communication between drivers, the results of the questionnaire revealed psychological negative impacts not only on drivers but also on people other than drivers, that is, pedestrians and residents living in neighbourhoods with narrow roads. Thus, there may be a need for other ways or for a new device to facilitate driver communication to replace the present usages of vehicle horns. Furthermore, transportation administrative agency may need to enlighten drivers about the impacts on listeners of vehicle horn use and so reduce necessary horn use to a minimum.

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