

Factors influencing driver safety awareness of hands-free cell phone use while driving

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Abstract—This study of 338 drivers was undertaken to investigate safe awareness and factors affecting their attitudes related to hands-free cell phone use when driving. Each participant completed a questionnaire through a website research company eliciting information about their demographic characteristics, social orientedness, driving habits, and self-ranked driving skills. The participants' classification distribution was decided by the question: Do you agree with the statement "It is ok to use a hands-free cell phone when driving." Group 1 included drivers who strongly disagreed or disagreed with the statement. Group 2 were those who strongly agreed, agreed or had a neutral opinion on this question. A binomial logistic regression model was built to explain factors that might model a driver's attitude. Results suggest that the age, driving pattern, social orientedness scale, and self-ranked driving skills were all variables that were significantly associated with driver attitudes related to hands-free cell phone use while driving. Results indicate that a person's attitude is associated with age, social orientedness, self-ranked driving skills, and driving patterns. The social orientedness scale suggests that society has a tolerant attitude related to driving while distracted with a hands-free cell phone, which demands more education by government.

Index Terms—Distracted driving, Safety awareness, Hands-free cell phone, Social-orientedness Scale, Driving pattern.

I. BACKGROUND/ OBJECTIVES AND GOALS

Distracted driving attributable to cell phone use is a chief cause of car accidents^{1)–3)}. Contrary to what some researchers have assumed, hands-free cell phone use when driving is not risk-free⁴⁾. Earlier research efforts have assessed similarities and differences between using handheld and hands-free cell phone while driving, revealing that use of either type of handset is an important distraction for drivers and an unsafe driving practice⁵⁾⁶⁾.

This study found that among 338 participants, 72.5% regarded the use of a handheld phone as "very dangerous" while driving, but only 23.3% of them regarded use of a hands-free cell phone as "very dangerous". They lack the necessary awareness of how dangerous it is to use a hands-free phone when driving. With the popular use of Bluetooth or hands-free devices of other kinds, such unawareness might pose a threat to road safety.

Furthermore, the legislation of many countries only cites distracted driving by handheld cell phones, these laws give the false impression that using a hands-free device is safe⁴⁾.

Moreover, because it is difficult to ascertain whether a driver is using a hands-free cell phone, it is difficult to ensure that drivers are driving with adequate concentration even when they have their hands on the wheel. This study undertakes analysis of factors affecting drivers' attitudes about distracted driving by hands-free cell phone from the perspective of driving tendencies and drivers' psychology to explain deeply what drivers think hands-free telephony is much safer than handheld telephony. Results can give more detailed information to support more comprehensive legislation for distracted driving, and to provide government with some direction for improving public awareness of distracted driving.

II. METHODS

A. Attendants

A total of 544 drivers completed the questionnaire. To enhance the quality of data collection, some general criteria were used to select valid responses. Only responses of drivers who drive more than once per month are used for analyses. Furthermore, drivers who chose the same choice to all questions were excluded. Consequently, as shown in Table 1, 338 respondents' answers were analyzed for this study. A survey overview is presented in Table 1. Part of the questionnaire was prepared to gather information from the drivers. Other survey parts were related to social

Table 1 Outline of the survey

Survey Date	2017.4.7
Traget Respondents	20-59 years-old drivers
Distribution Method	Web research
Number of Distributed Questionnaires	544
Number of Analyzed Questionnaires	338
Main Contents	driver awareness and experience related to distracted driving, personalities of drivers, driver demographics

orientedness measurement, driving tendencies, awareness and experience about using a cell phone when driving, awareness about risky behaviors, and accident involvement.

B. Measures

1. Demographics

The authors designed some questions eliciting demographic information of the participants related to age,

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sex, family composition, and career. Details are presented in Table 3.

2. Social orientedness scale

The social orientedness scale was proposed by Minako, I. to ascertain the adjustment level and development level of human beings⁷⁾. As shown in Figure 1, we selected seven questions to measure the social orientedness of respondents. All statements were rated to respondents on a five scale from “true” to “false”. After they were transformed into z-scores, they were inserted into the factor analysis by SPSS to obtain the social orientedness scale cluster.

3. Driving pattern

A total of 14 questions related to driving habits were selected to analyze drivers’ driving tendencies. We attempt to ascertain what kinds of drivers believe that using a hands-free cell phone is safer than using a normal cell phone

C. Analyses

Data were analyzed using software (SPSS Statistics 24; IBM Corp. and Excel Analysis ver. 2015; Microsoft Corp.).

III. RESULTS

A. Demographic items

All items that explain a driver’s background were used to test for differences in sex, age, career, family composition, driving age, frequency, average driving distance, and self-reported driving skills among respondents. Among those variables, only age, driving frequency, self-ranked driving skills were found to differ significantly between groups. The percentages of respective items are presented in Table 3.

1. Age

From the table shown above, there are two groups to describe the driver age distribution: the young group and elderly group. Age can be a dummy that is useful to assess what drivers might hold an incorrect belief related to hands-free issues. Shown as Figure 2, compared to the young group, elder drivers are more cautious about this question.

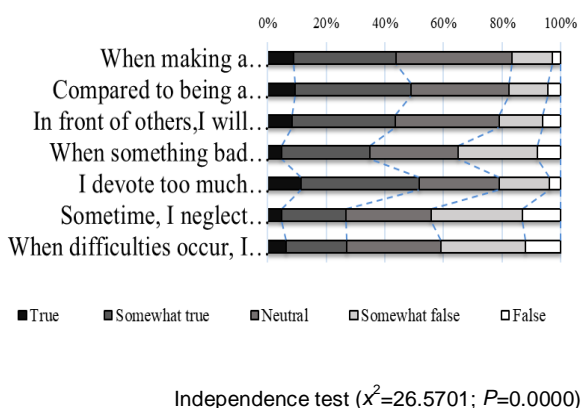


Fig 1 Results of social orientedness scale

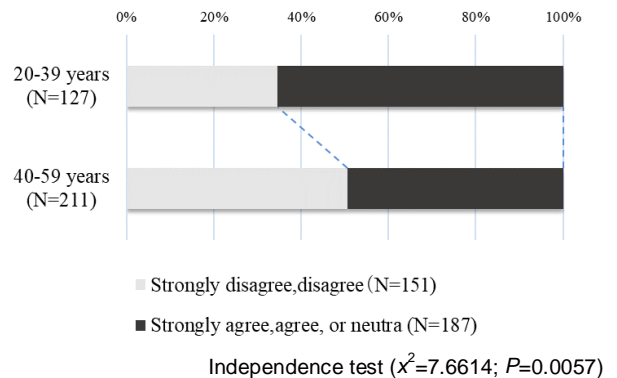


Fig 2 Relation between age and attitudes towards driving with hands-free cellphone use
Table 2 driving habits questions

Questions about Diving Habits

- ① I always keep speed regulation
- ② Drive while constantly checking the speed meter
- ③ I try for stable driving
- ④ It is trying not to be stepping on a sudden braking except in emergency
- ⑤ Be sure to pause at "Stop"
- ⑥ Be sure to temporarily stop when a road crossing person is present
- ⑦ Pedestrian and bicycle priority driving are important
- ⑧ When overtaking a pedestrian or a bicycle, slow down
- ⑨ Stop with yellow signal
- ⑩ When starting off, make sure of the left and right front and back
- ⑪ Do not enter the road side band as much as possible
- ⑫ Keep adequate inter-vehicle distance with front car
- ⑬ Transfer the way to the oncoming vehicle
- ⑭ I remember all the meanings of road signs

2. Self-ranked driving skills

For questions related to driving skills, six choices were presented to drivers, reflecting their confidence in their driving skills. For example, the person who ranked him/her at 80 points is much more skilled than the driver who ranked at 60 points, this is not a judgement by others, but only the self-positioning. Results show that the people who have strong self-confidence in their driving might compromise their alert to the potential risk, engendering higher accident involvement probability. As the Figure 3 shows, a driver who thinks their skill is 80 points or more (full=100) is more likely to agree that “using a hands-free cell phone is ok when driving”. The results proved the former hypothesis.

B. Social orientedness scale

Social orientedness is a psychology concept which, together with individual orientedness, are proposed to ascertain personality traits, adjustment level, and developmental level. Study results show that social approval affects the frequency of using a hands-free mobile phone while driving⁵⁾. To ascertain whether social approval affects a driver's attitude on hands-free cell phone when driving, the authors added these questions. Results for social orientedness items were transformed into a z-score. Using software, two clusters were obtained as shown in Table 4. The number of symbols of respective clusters, the means and standard deviations of the social orientedness scale, and standard error are shown.

Depending on the two clusters (Kruskal–Wallis test and multiple comparison: P value < 0.001, one-way analysis of variance: P value < 0.001), the drivers were divided into two groups, high social orientedness and low social orientedness. The two groups were significantly different in terms of the awareness of the risk of distracted driving by hands-free cell phone use. Apparently, the higher the social

respondent had to agree with the statement. Perhaps, at a society level, a person believes that using a hands-free cell phone is a sufficiently safe task when driving. So, the more people gets adapt to the community, the more they neglect the danger of this behavior.

C. Driving tendency pattern

Driving patterns directly affect driving behavior. To investigate associations between driving tendencies and awareness about hands-free cell phone use, we used a set of driving pattern questions to classify drivers. The driving pattern questions include 14 items listed on a five points scale from “true,” “probably true,” “all the same,” “probably false,” to “false.” The results were analyzed using software (Excel Analysis 2015 (Japan); Microsoft Corp.) to obtain three factors related to driving tendency, with factor 1 being care about all surroundings, factor 2 representing devotion of attention to speed more than other drivers or pedestrians, and factor 3 representing care about other road users. From the choices of the respondents, we obtained four driving type clusters: safe driving type, care about speed driving type, care about other road users type, and the dangerous driving type.

After obtaining the four types of driving tendencies, both the second and third types can be described as cautious driving. Therefore, these two were combined into one to

Table 3 Descriptive statistics of the participants' demographic questionnaire survey

Driver demographicsVariables	Levels/values	Percentage(%)	P value
Gender	male	59.1	0.049
	female	40.9	
Age	young (20-39)	37.6	0.006
	elder (40-59)	62.4	
Career	officer/government officer	53.2	0.031
	self-employed works	10.7	
	part-time workers	11.2	
	others	24.9	
Family Composition	live alone	12.42	0.572
	live with couple	12.42	
	two generations	62.13	
	Three generations	10.06	
	others	2.96	
Driving Periods	20 below	41.42	0.113
	above 21	58.57	
Driving Frequency	every day	50.59	0.030
	1-3 times/week	35.5	
	1-3times/month	13.91	
Driving Distance/year	less than 5000km	54.73	0.017
	more than 5001km	45.27	
Driving Skill	above 80	46.15	0.007
	less than 79	53.85	

Table 4 Social orientedness scale cluster

Factor A	n	M	(SD)	(SE)
Cluster 1	258	0.413	0.701	0.044
Cluster 2	80	-1.333	0.558	0.062

orientedness scale was, the stronger the preference a

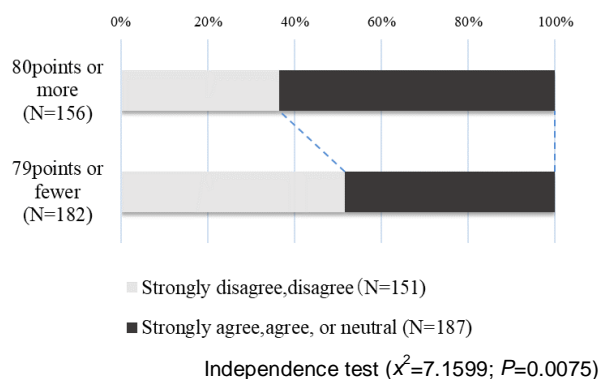


Fig 3 Relation between self-ranked driving skill and attitudes towards driving with hands-free cellphone use

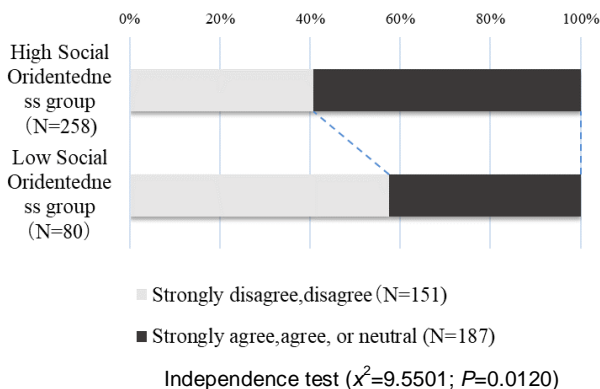


Fig 4 Relation between social orientedness and attitudes towards driving with hands-free cellphone use

ascertain whether the driving tendency has a connection to opinions regarding acceptance of driving with a hands-free cell phone.

Consistent with common sense, the more cautious a driver is, the more probably the driver will be worried about distractions caused by hands-free cell phone use, as shown in Figure 5. The percentage of agreement with the saying is the lowest for safe driving, but highest for dangerous driving.

IV. DISCUSSION AND CONCLUSIONS

The current study was conducted for two reasons. First, this study was conducted to assess circumstances in Japan related to drivers' attitudes about the safety of hands-free cell phone use while driving. Results show that nearly 72.5% believe that it is "very dangerous to answer/make a call using a handheld phone while driving," but only 23.3% of drivers think that to "answer/make a call by hands-free cell phone while driving is very dangerous." This situation should compel government officers to improve public awareness about this hazard.

The second aim was to detect what kinds of drivers might have incorrect impressions about distracted driving because of hands-free cell phone use. Results can offer a new perspective for improving the legal system.

We detected many factors of the background of drivers related to attitudes. Gender was unrelated to responses to this question. Instead, age emerged as a risk factor predictive of agreement on this statement. Aside from demographic variables, the social orientedness scale, which is representative of pro-society attitudes apparently indicates that drivers who are better adjusted into society are more likely to regard using hands-free cell phone as acceptable. One interpretation of this phenomenon is that the public has little awareness of how dangerous distracted driving by hands-free phone is. Probably for the public, distracted driving by cell phone is only visual, without involving the hands. Because it does not inhibit actual sight, using a hands-free device for talking is quite the same as talking with a passenger in the car. This result reveals a lacking public education related to safe driving. Skilled drivers are not necessarily safe drivers. In this study, drivers who ranked themselves at a high level tend to agree that using a hands-free cell phone is not a hazard when driving. Driving patterns exhibit a strong relation with the awareness of distracted driving.

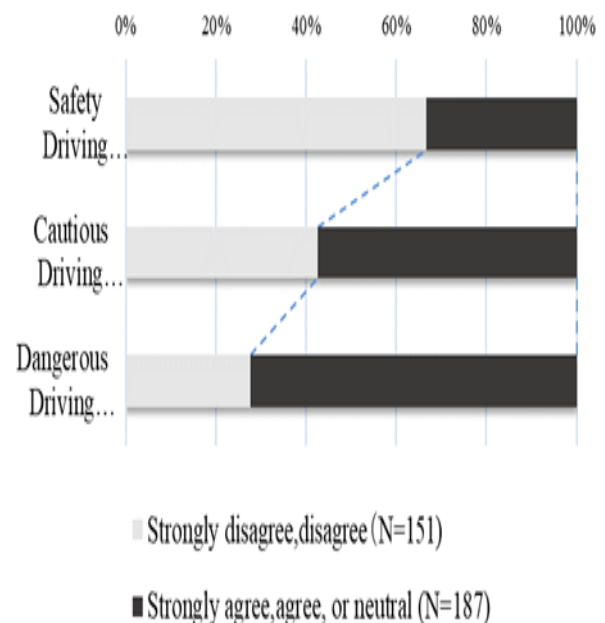
Table 5 Cluster results of driving behavior question responses

Factor		No.1	No.2	No.3	
Cluster	N	Care about All Surroundings	Care about Speed	Care about Other Drivers, Pedestrians	
1	Safe Driving	81	0.977	0.815	1.247
2	Care about Speed Driving	119	-0.051	0.38	-0.019
3	Care about Other Drivers Pedestrians Driving	55	-0.148	-1.319	0.356
4	Dangerous Driving	83	-0.782	-0.466	-1.426

A binomial logistic regression model was built to show

the effects of respective variables. As shown in Table 6, younger drivers were more likely have an inclusive attitude than elderly drivers, perhaps because they use phones more often. The preference to agree on the statement shows a negative correlation with higher social orientedness. Driving tendency holds the largest odds ratio. Results of this study lead to the conclusion that, even though the driver might know little about distracted driving hazards posed by using a hands-free cell phone, safe driving habits require that they avoid such distracted driving. As earlier studies have shown, self-ranking of driving skills is not good all the time. This study showed that if less confidence means more caution, then less confidence means fewer accidents.

The percentage of correct classifications was 65.09%. Results of this study suggest the following. (1) Driver patterns have the strongest relation with people's awareness on this question. Improving safe driving awareness is of great importance. (2) Age strongly affects driver attitudes. (3) When drivers have self-confidence about their driving, they might be less alert to unsafe attitudes about driving with phone use. (4) The social orientedness scale reflects the drivers' safe attitudes related to driving with a hands-free cell phone. This study provides insight into social attitudes. Society lacks necessary education related to hazards of driving with hands-free devices, suggesting that government and private companies should increase their efforts. Among all the dummy variables, the driving pattern, age and self-ranked driving skills formed the first three factors affecting driver choices.



Independence test ($\chi^2=26.5701$; $P=0.0000$)

Fig 5 Relation between driving pattern and attitudes towards driving with hands-free cellphone use

Table 6 Binomial logistic regression model for the variables significantly affect driver attitudes

	Dummy variable		Partial regression coefficient	Odds ratio	P value	
Independent variables	Age	1. 40–59 years	0.7012	2.0161	0.0049	***
		0. 20–39 years				
	Social-oriented	1. High social individual-oriented	-0.5181	0.5956	0.0631	*
		0. Low social individual-oriented				
	Driving pattern	1. Safe driving	0.949	2.5831	0.0011	***
		0. Others				
		1. Dangerous driving	-0.5691	0.566	0.0565	*
		0. Others				
Self-reported driving skills	1. ≤ 79 points	0.6753	1.9646	0.0048	***	
	0. ≥ 80 points					
Dependent variable	1: Strongly disagree and disagree: using a hands-free cell is ok when driving		-0.7308	0.4815	0.0325	**
	0: Strongly agree and agree or neutral: using a hands-free cell is ok when driving					
Determination coefficient			Cox–Snell	Nagelkerke	R2 value	
			0.1249	0.1671	0.097	
Significance of regression expression			P<0.001			
Percentage of correct classification			65.09%			

Notes: N=338

***Significant at P<0.001 level

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