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Chinese truck drivers' attitudes toward feedback by technology: A quantitative approach

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ABSTRACT

This study examined Chinese truck drivers' attitudes toward receiving feedback about their driving performance by in-cab technology and explored the best ways of providing feedback to truck drivers in China. The similarities and differences between US and Chinese drivers were also compared. Survey data were collected from 200 long-haul truck drivers in China to provide quantitative information. The results of the current study were compared to the results of a previous study published in 2006 which utilized focus group discussions with Chinese truck drivers, and to the data of a similar survey conducted in the US and published in 2005. Results of the current study showed that Chinese truck drivers were eager for more feedback about their driving performance and they were willing to receive feedback from technology. Although negative feedback was most prevalent in their working environment and was considered acceptable if it improves driving safety, they considered positive feedback as more helpful to safe driving. They perceived many benefits of receiving feedback by technology and comparatively few drawbacks and concerns. Compared to US truck drivers who strongly preferred feedback from a human (e.g., safety director, dispatcher) rather than from technology, Chinese truck drivers were more positive in terms of receiving feedback from technology. They considered feedback from technology to be more objective and scientific than feedback from humans. This study showed the importance of considering cross-culture differences when planning to apply interventions in different countries and cultures.

1. Introduction

The Chinese economy has been growing rapidly with freight traffic via highway doubling from 1990 to 2006. At the same time, economic loss from motor vehicle incidents increased dramatically from 44.34 million RMB (about 5.99 million USD) in 1990 to 1940 million RMB (about 262.16 million USD) in 2006 (China Development and Reform Committee, 2004, 2007). The reports of China Road Traffic Incidents Statistics (CRTIS, 2001, 2002, 2003, 2004, 2005) indicated that trucks caused the highest percentage of deaths in road incidents compared with other types of vehicles (23.09% in the year 2001, 22.16% in the year 2002, 27.32% in the year 2003, 22.2% in the year 2004, and 21.78% in the year 2005). Chen et al. (2002) reported that trucks were very likely to be involved in crashes in China because of the poor condition of the trucks and frequently observed unsafe driving behaviors.

Furthermore, in China, according to police reports which categorized the reasons for accidents into driver and other road users, vehicles, road conditions and weather (CRTIS, 2003, 2004, 2005), human factors were estimated to be associated with 95% of the car accidents. The combination of the issues with truck involvement in crashes and driver behavior make it important to study and find ways to improve truck drivers' driving behaviors in order to improve driving safety in China.

1.1. Using technology to provide feedback to Chinese drivers

There are now more and more in-vehicle technologies available to enhance safe driving for truck drivers, such as collision avoidance systems, lane departure warning, rollover detection and driver alertness monitors (Donmez et al., 2007; Parasuraman et al., 1997; Rötting, 2002; Sheridan, 1992; Wouters and Bos, 2000). Research has shown that providing feedback to drivers about how they drive can potentially improve safety performance (e.g., Hutton et al., 2001; Komaki et al., 1978; Zohar, 2002). For example, a study found that passenger-observer feedback is useful for positive behavior modification (Hutton et al., 2001). Since in-vehicle technologies

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now can collect data on safety-relevant aspects of driving behavior (e.g., speed of the vehicle, headway distance, erratic steering behavior, driver alertness), it may be possible to use the parameters gathered from these technologies to provide feedback, specific information about how they are driving, to truck drivers who often work alone for a long period of time without opportunities to receive feedback from their colleagues (Huang et al., 2005). This concept could be applicable to different cultures or environments. In China, feedback by technology is a new idea to truck drivers. In our earlier study (Zhang et al., 2006), we collected focus group data to explore Chinese truck drivers' attitudes toward technology which showed they perceived potential benefits of receiving feedback by technology.

1.2. Previous studies

This study is the final phase of a research series on truck driving safety conducted in both the US and China. In the first phase, both qualitative and quantitative studies were conducted in the US (Roetting et al., 2003; Huang et al., 2005). The results showed that US truck drivers would like to receive more feedback, preferably from a human, but feedback by technology would be acceptable if supplemented by human feedback. Positive feedback (such as recognition for driver's good job) was perceived as being more useful than negative feedback (such as being criticized for doing something wrong). Drivers saw the main benefit of in-vehicle technology as providing better information about their behavior in traffic mishaps. Nearly half indicated that feedback by technology would make them safer drivers. Participants felt uncomfortable with being watched by technology and were concerned how their driving performance data would be used. Privacy issues, such as confidentiality of the data or its being used against drivers, were consistently brought up by US drivers. Drivers also had varied preferences regarding the modality, frequency, and timing of feedback by technology, which indicates the need for flexibility and/or adjustability in such systems.

The second phase study (Zhang et al., 2006) collected qualitative data to explore the safe/unsafe driving behaviors of Chinese truck drivers and to examine Chinese truck drivers' recognition of the need for feedback and their attitudes toward receiving feedback from both technology and from individuals to improve driving safety. Eight sessions of focus group discussions were carried out with Chinese truck drivers, middle-level managers in the freight transportation business, and traffic policemen. The results showed that the most important safety issues to Chinese truck drivers were speeding and overloading. Chinese truck drivers would like to receive more feedback, although they reported that the feedback they typically received was negative. Some Chinese truck drivers were afraid of not being able to operate the in-vehicle technology; however, in general, they were very positive about feedback by in-vehicle technology because it was considered objective and scientific. For this reason, feedback by technology was preferred by some participants over feedback from a human.

1.3. Purpose of the study

The purpose of this current and final phase of the study was to conduct a survey of Chinese truck drivers, using a quantitative approach, to complement prior Chinese focus group qualitative data (Zhang et al., 2006). The survey explored whether truck drivers in China want and seek feedback and what the attitudes and opinions of truck drivers were on receiving feedback by technology. Furthermore, the Chinese survey data were compared with the data from the US (Huang et al., 2005) to find similarities and differences between Chinese and US truck drivers.

2. Method

2.1. Participants

This study focused on Chinese long-haul truck drivers as the survey participants. Questionnaires were collected from 200 drivers recruited from two long-haul truck stops in Beijing. The recruiting method used was similar to our US study (Huang et al., 2005). Every driver was asked to fill in a personal information form attached to the questionnaire to provide further demographic information as reported in Table 1. This study received human subject approval from the Liberty Mutual Research Institute for Safety's Institutional Review Board.

Among the participants, 99% ($n = 198$) were male. The age of drivers ranged from 20 to 50 years with a mean of 32.77 (S.D. = 6.32). Chinese drivers resided in 18 provinces/autonomous regions/municipalities. Most drivers (88.5%) drove more than 50k miles per year and almost half of the respondents (48.5%) reported driving more than 50 h a week. The average number of years that the participants had been working as professional truck drivers was 9.01 (S.D. = 5.12) with a maximum of 25 and a minimum of 1. One-third of the participants were union drivers, 48% were owner operators and 31% were paid by a fixed portion of the delivery fee. Most drivers (94%) drove with their partners. About 8.5% of drivers reported they had experienced a crash in the past 12 months. A majority of the long-haul drivers (67%) reported that they did not have previous experience with in-vehicle technologies which can provide feedback to drivers.

2.2. Survey measures

The survey questions were developed and adapted from the previous studies (Roetting et al., 2003; Huang et al., 2005) and the results of prior focus groups conducted with Chinese subject-matter experts (Zhang et al., 2006). Those items originally used in the US were translated from English to Chinese and were later back translated from Chinese to English by different bi-lingual experts. Items were revised until the equivalency of the meanings of the translated items were agreed on by the project team (including a consultant who was a former truck driver in China). The definition of feedback was listed in the cover page of the questionnaire as "providing drivers with specific information about how they drive" as used in Huang et al. (2005). With the exception of the demographic information and the ranking of the most important critical safety behaviors, responses were made using a 5-point Likert scale ["Strongly disagree (1)," "Somewhat disagree (2)," "Neither agree or disagree (3)," "Somewhat agree (4)" and "Strongly Agree (5)"] as originally used in the US. The questionnaire contained 33 fundamental statements assessing the 6 topics and 1 additional statement:

(1) Would Chinese truck drivers like to receive more feedback about their driving performance? (8 items)
(2) What are the perceived benefits of receiving feedback by technology? (3 items)
(3) What are perceived drawbacks and concerns of receiving feedback by technology? (8 items)
(4) What is the preferred form of feedback by technology on driving performance? (11 items)
(5) From whom would Chinese truck drivers like to receive feedback? (2 items)
(6) What are the most important safe driving behaviors in China? (1 item)
(7) Additional statement: perceived crash risk and willingness in helping to develop a feedback by technology program (2 items).