SEAT BELT USE AND REMINDER SYSTEMS: ASSESSING THE ACCEPTABILITY OF INTELLIGENT SEAT BELT REMINDER SYSTEMS

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ABSTRACT

The likely introduction of intelligent seat belt reminder systems led to a project to develop a method to assess the acceptability of intelligent transport system technologies and to apply the method to intelligent seat belt reminder systems. Both SAAB and Volvo intend to introduce seat belt reminder systems that are designed to be invisible to vehicle occupants who use their seat belts and to annoy occupants who do not use their seat belts. The assessment method involved simulating the social processes likely to associated with the introduction of new in-vehicle technologies, combined with measurement of individual responses to the technology. The application of the method to a sample of drivers who were identified as less likely than others to wear seat belts involved conducting 12 discussion groups. The results of this study suggested that the main reason for non-use of seat belts relates to forgetfulness or failure of early driving cues to generate appropriate seat belt behaviour. They also suggest that the response of non-users to the seat belt reminder system is likely to be very positive.

INTRODUCTION

Intelligent Transport System (ITS) technologies are widely viewed as important potential road safety measures. Technologies are increasingly available to assist the driver make decisions while driving or, in extreme circumstances, to take limited control of the vehicle. Proponents of the ITS approach do not often attend to the motivational or psychological factors that might interfere with the success of these technologies. There is a range of driver-related factors that might be expected to aid or hinder ITS measures, and there is an increasing need to assess the potential impact of these.

The first important psychological issue is acceptability. ITS technologies that are not acceptable to drivers are unlikely to have a positive effect on driver behaviour or motivation. The potential for tampering, or the possibility that drivers will abandon manufacturers who introduce unacceptable technologies cannot be discounted. Evaluations of acceptability that rely on drivers involved in on-road trials of ITS systems are likely to be biased towards acceptability, however, as people who volunteer to drive a high-technology vehicle would be expected to be positively disposed towards the technology prior to the assessment.

The intelligent seat belt reminder system is an important ITS technology that will soon be introduced into vehicles in Europe, with manufacturers elsewhere likely to follow this lead. These devices detect occupants and their seat belt use in all seating positions, and then create a series of increasingly annoying visual and auditory alarms associated with vehicle speed or time to encourage seat belt use. They are not interlock devices, but seek to make driving without seat belts uncomfortable.

Vägverket (the Swedish National Road Administration) commissioned a project to develop and trial a method for assessing the acceptability of intelligent seat belt reminder systems, with a broader view that the assessment method may be applicable to other ITS technologies. The method was to be one that did not rely on the availability of the technology for participants to trial.

The method developed by the first author focused on a simulation of the social processes that would be expected to occur with the introduction of a new technology such as the seat belt reminder system. It was thought that the introduction of a new technology would evoke an initial reaction on the part of individual drivers, that there would then be social interaction focusing on the new technology and further forming opinions and behavioural intentions, and then that the actual response to the technology would be an individual one based on opinions formed partly as a result of the social processes.

The importance of social processes in the formation of driver attitudes and in the generation of behavioural responses to the new technologies was a key aspect of the method proposed for this study.

It was considered that social processes are generally neglected in studies of the interaction between technology and users, although it is clear that social factors are important determinants of behaviour both on the road and more generally. In the case of ITS technologies, social processes could act either to encourage a positive reaction to the technology or to encourage a negative response. When ITS technologies are introduced, understanding the social processes that result (and perhaps influencing them) may be of critical importance.

The study reported here trialed the method developed to assess the acceptability of intelligent seat belt reminder systems amongst drivers identified as less likely to use a seat belt, with a view to making recommendations about the method and about the likely response of Australian road users to seat belt reminder systems. This paper summarises a more-complete report of the project (Harrison & Senserrick, 2000), in which the results of detailed statistical analyses are reported.

METHOD

Participants

Participants were recruited during a survey on seat belt use reported in an accompanying paper at this conference (Senserrick & Harrison: *Self-reported seat belt use and related attitudes*). The survey was a random telephone number survey of households within a limited radius of the University conducted on weeknights. The survey respondent was selected from the household based on birthdates to minimise one source of selection bias. There were 954 respondents in the survey.

Participants for this study were recruited from survey respondents during the survey, based on their responses to criterion items concerning seat belt use that were identified as discriminating items based on earlier trialing of the survey. Almost half the survey respondents (452) were asked to take part in a further discussion group at the end of the survey, and 215 agreed to do so. There were no significant differences between those who agreed and those who refused on sex, age, or any of the seat belt items.

Those who agreed were then contacted by telephone in no particular order and were placed into one of 12 discussion groups. There were 72 participants in the trial of the assessment method. Participants were paid for their time.

Procedure

The discussion groups were led by one or other of the two co-authors. Groups were scheduled at night or on the weekend, and were conducted in a meeting room at Monash University. The discussions were video taped, and the tapes then used by the first author to review each session and to extract thematic information and discussion issues from the meetings. Each discussion group took about 2 hours.

There were three main phases to the assessment method. Participants completed an initial detailed questionnaire concerning seat belt use patterns and motivations, which included items probing their likely reaction to a new seat belt reminder technology. Participants were then informed about the new seat belt reminder system, in part relying on the group leader and in part on a video presentation provided by Vägverket. This was then followed by a loosely structured discussion session in which participants were prompted to discuss a series of issues concerning the technology. They were encouraged to discuss their reaction to the technology and their predictions about others' reactions, predictions about how it would influence seat belt use, how they could defeat the technology, and whether they would do so. The group discussion was then followed by a final questionnaire, completed individually, which sought information about how participants would behave if they had a car with the system installed, and how they thought people in general would behave.

Thus, the method here attempted to simulate the social process discussed briefly above.

RESULTS AND DISCUSSION

Key results only are summarised here. The reader is directed to Harrison and Senserrick (2000) for a fuller treatment of them.

Pre-Survey

Participants completed a detailed summary of their seat belt use across difference contexts (eg. time of day, weather conditions) and different driving actions (from starting the car through to high-risk situations such as driving in heavy traffic). There were no significant differences in seat belt use across driving contexts, but there were differences in seat belt use in different driving actions. Seat belt wearing rates amongst participants ranged from 42% of the time when starting the car to 99% of the time when driving on freeways. Seat belt wearing rates were above 90% in most driving situations.

The high seat belt usage rate amongst this group, who had been identified as less likely to use seat belts, was interesting. It is possible that it reflects, in part, an element of social desirability, although it is difficult to understand why social desirability would impact on this survey and not the telephone survey which originally identified them. An alternative explanation of the high wearing rate is that the low-level seat belt users recruited for the discussion groups are inconsistent seat belt users rather than consistent non-users. This issue is discussed below.

Participants were asked to rate the strength of various motivations that might encourage or discourage seatbelt use, and their responses suggested that seat belt non-use might have been a result of forgetfulness rather than a decision not to use a seat belt. Seat belt use when pulling out from the kerb was significantly correlated with motivational items such as "I don't think about it, I just wear it", "Putting it on is automatic", and "I just put it on without thinking about it". It was significantly negatively correlated with motivational items such as "It's easy to forget to put the seat belt on", and "I never got into the habit of wearing a seat belt".

These results together suggest that seat belt non-users might normally be seat belt users who are cued later in the driving task to wear their seat belt. They tended to have high wearing rates in higher-risk driving situations, and they indicated that they tended to forget to put their seat belt on. One possible explanation is that situational characteristics cue drivers to wear a seat belt in different ways. The inconsistent wearers in the discussion groups are such because they are not cued to wear a seat belt by the same early-factors that cue other drivers.

Discussion Groups

The group discussions proceeded without any problems. Some groups were more engaged in the process than others, and the presence of a technically competent person in some groups had a positive effect on the level of discussion. Groups were keen to be involved and participants seemed genuinely interested in the technology.

A number of themes recurred throughout the group discussions, including the following:

- A generally-positive reaction to the system as a reminder: Participants were all positive about the technology as it was presented, most likely because most blamed their non-use on forgetfulness. Some also thought it would be useful to encourage seat belt use by others in the car, especially children in the back seat.
- Price: Participants in most groups raised concerns about the potential impact of these devices on the price of cars, and more importantly on the price of repairs if the technology malfunctioned (see below).
- Reliability: This was perceived to be an important issue in every group. Participants expressed a need for 100% reliability given that many had heard about technology-related problems in new vehicles, especially in the engine-management systems. Some participants suggested a lifetime warranty for the device as a way to minimise concerns, although the potential problems associated with obtaining repairs were noted by some. These were thought to be a particular problem in less-populated areas of Australia.
- Volume of warning tone: Most participants agreed that the tone (as presented in the videotape) was loud enough. Some participants were concerned that the tone might not be heard over some sound systems, and that deaf people (or people with various hearing impairments) might not hear a tone.
- Child seats and restraints: Most groups raised potential problems with child restraints, particularly those that relied on a permanently fastened seat belt as part of the restraint mechanism. The suggestion that the devices might not respond to weights below some critical level that matched

the weight of a child restraint raised concerns that it might therefore not respond to light children in normal seat belts.

- Avoiding the technology: Participants suggested a number of ways of defeating the technology, none of which were likely to be a problem for the intelligent technology suggested for the reminder system. The only common suggestion that might present a problem (apart from people locating a skilled auto-electrician who might be able to interfere in the system) was the installation of a manual extension to the disarming button in the engine bay that would allow drivers to disarm the system from inside the vehicle. A couple of participants suggested a cable-based extension to this that could depress the button. Very few participants expressed any interest in tampering with the technology. Those that did were male and generally younger – wanting to try it out as a challenge but not particularly interested in avoiding the reminder itself. A common theme amongst participants was "why bother?" Participants seemed uncertain about why people would try to disconnect the technology given that they perceived it to be a positive innovation.
- Loads in the car: Some participants were concerned about the effect of carrying luggage or larger pets in the motor vehicle. Although they were aware of the road safety problems associated with carrying unrestrained luggage and pets, they were concerned to ensure that the technology would not interfere with these activities. This was thought to be a potential source of annoyance for some dog owners.
- Habitual seat belt use: Participants generally felt that the reminder system would help them to develop better seat belt habits. They indicated that they would probably change their behaviour to avoid the warning tones, and that they expected this behaviour to transfer to other vehicles (without the system). Only a few participants suggested that the device might be relied on by drivers and that this might result in reduced seat belt use in other vehicles.

Participants in the last five groups were asked to comment about other ITS technologies being considered now. It was considered important to seek some data on this issue, and to assess the usefulness of a discussion-group approach for assessing the acceptability of these technologies. These discussions took place after participants had completed the post-survey, to ensure they did not interfere with participants' responses to that survey. The discussion resulted in the following main themes:

- Alcohol interlocks: The attitude to alcohol interlocks was very positive. This was particularly so for interlocks with a passive technology. This positive response may (in part) relate to ongoing publicity of this potential solution for recidivist drink drivers in Australia.
- Complexity: There was concern about the increasing complexity of the driving task in relation to the intrusion of technologies. Some participants expressed concerns about the reaction of older and younger drivers to warning signals, suggesting that confusion or panic would need to be avoided.
- Reliability: The participants were concerned about the potential for reliability problems in the context of technologies that could influence driving behaviour.
- Reliance on the technology: A number of participants indicated that they would be concerned that some drivers may rely too strongly on the technology to identify hazards and to set limits on their behaviour. It was suggested that drivers might concentrate less in this situation.

Unlike the discussion relating to seat belt reminder systems, the attitude of participants appeared to become more negative during these discussions.

Post-Survey

Participants completed a questionnaire concerning their likely reaction to the seat belt reminder system once introduced. Figure 1 shows mean responses to items concerning individual reactions to the possibility of having a car with this technology. The agreement scale ranged from 0 to 10, with 0 representing no agreement and other numbers increasing levels of agreement with the statement.

Responses were generally very positive, with the highest level of agreement associated with items that suggested a favourable level of acceptance of the technology and lowest agreement levels to the more-negative items.

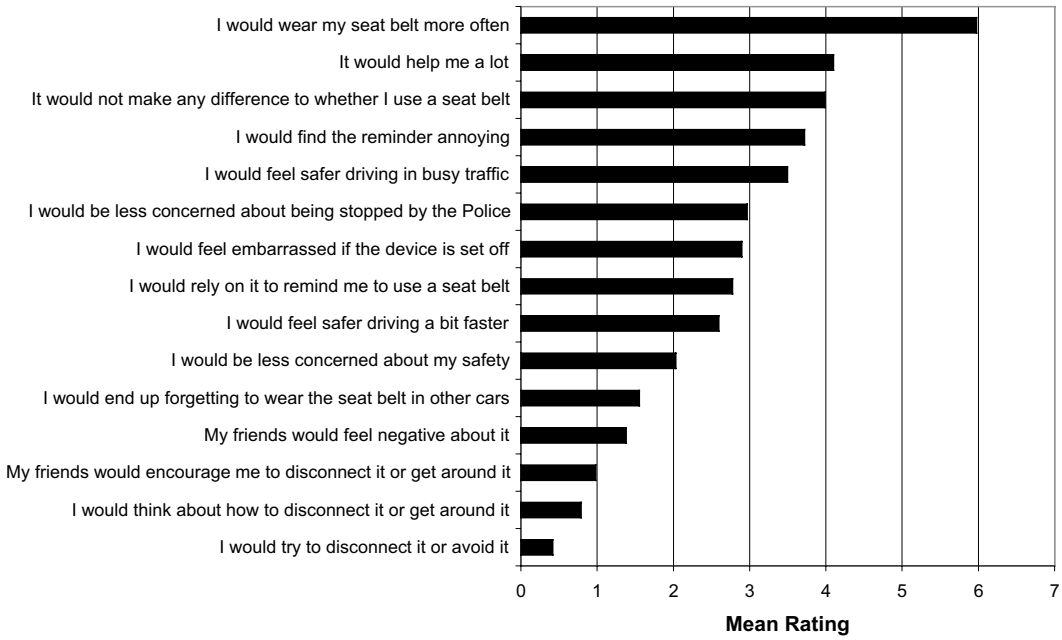

Figure 1: Responses to seat belt reminder system items in the post-survey

GENERAL DISCUSSION

There were a number of important findings from this study.

The first related to the seat belt wearing behaviour of people identified as less likely to use their seat belts. When the study was first formulated, it was thought that there were potentially two groups of non-users. The first group would be consistent non-users of seat belts, and the second would be inconsistent users. In addition to the obvious behavioural differences between these two groups, it was thought that there might be some motivational differences that would influence the acceptability of a technologically sophisticated seat belt reminder system. Consistent non-wearers might be expected to have a clear negative attitude towards seat belts that would, in turn, potentially lead to a negative attitude and behaviour towards the reminder system. Inconsistent wearers might have different reasons for non-use, and might be expected to have more-positive attitudes towards seat belts and the reminder system.

The weight of evidence in this study suggests that most seat belt non-use in the discussion group sample related to inconsistent use rather than consistent non-use. No consistent non-wearers were identified. This does not mean, of course, that all non-use is a result of inconsistent use, but it does suggest that there is at least a sizeable proportion of non-users who are sometimes cued to wear their seat belt and so who may be positive towards the reminder system.

The inconsistent seat belt use seemed to relate to forgetfulness, or more accurately to the situational cues that reminded the driver to use their seat belt. Forgetfulness and habitual use were clear predictors of the level of seat belt use, and these issues were raised often in the discussion groups. Habitual behaviour can best be understood as automated behaviour cued by some external event, so it is possible that seat belt use, for users, is cued early in the sequence of events that surround driving, while for the inconsistent user is cued later in the sequence – perhaps by entering busier traffic. In this context, the seat belt reminder system may result in significant increases in seat belt use amongst non-users. It will potentially act to cue seat belt use earlier in the driving sequence.

The reaction of participants to the seat belt reminder system was the second important finding. It was clear that there was general acceptance of the system amongst participants. This was generally characterised as a response to the reminder-value of the system, as participants viewed their non-use as related to their failure to remember to use their seat belt. There were no participants who indicated that they would not be prepared to have this type of technology in their vehicle, and participants generally indicated that they could not understand why people would want to disconnect or tamper with the system given its potential positive effect. The results of the post-survey supported this. The concerns

raised by participants were consistent between groups. The main issue raised related to the reliability of the technology. Participants were generally concerned that the technology would fail, and many indicated that events of this type would make them feel negative about the system. Participants were also concerned about some of the practicalities associated with the system, such as how the technology would interact with child restraints and carrying loads or pets in the vehicle.

Another important finding related to the reaction of participants in the last five discussion groups to the additional ITS technologies that were discussed. While participants were positive about alcohol interlocks, they were clearly negative about other ITS technologies such as intelligent speed adaptation, automatic cruise control, and collision warning systems. They were concerned (again) about reliability issues, and also expressed concerns about the possibility that people might rely on the technology too much. Many, especially older group members, were concerned about the increasing complexity of the driving task, believing that additional technologies would add to this complexity rather than lessen it.

The final important finding of the study related to the method itself. The method was designed to simulate some features of the social processes that were thought likely to occur with the introduction of a new technology. In day-to-day life this would most likely involve discussions about the technology between friends, family, work colleagues, and other social groups. It is likely that the general feel of these discussions would influence the response of drivers to the technology. The method was designed to simulate the discussions themselves so that the final response of participants was based on the information received about the technology, their initial reaction, and the reactions of others in the discussion.

The discussions seemed to work well. The format became more relaxed and less question-and-answer focused as the facilitators built up experience with this approach, and participants generally seemed comfortable with the format. Participants were asked about their reactions to the discussion group format, and agreement with statements (not reported above) such as "This discussion has been quite realistic for me" were generally high. Written comments were also requested during the post-survey, and these suggested that the discussion group format gave all participants an opportunity to share and hear the opinions of others.

RECOMMENDATIONS

Acceptability of ITS technologies is likely to be an important issue as these devices become available over the next decade. Although there are many human-factors issues yet to be addressed, their promise as potential road safety measures ensures that the current momentum amongst manufacturers and some researchers will continue. It is possible, however, that drivers will not share the same enthusiasm for this type of technology. Certainly the results of the discussion groups that included a discussion of other ITS technologies suggests that there may be a number of concerns amongst drivers that will lessen the road safety benefits arising from the technology if not addressed.

It is therefore strongly recommended that the development of ITS technologies be accompanied by a substantial research program to investigate factors that influence their acceptability with road users. This research program could take a number of forms, but it is clear that the method used here provides an effective way to assess acceptability without biasing the selection of participants too strongly towards those who are interested in technology. The method also provides a method to select target groups for each study, so that speeders could be selected for an investigation into the acceptability of speed-control devices. The focus of this type of research would be the development of recommendations for improved design and marketing to minimise the concerns of drivers.

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REFERENCE

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