Don't Blame me I am Only the Driver: Impact of Blame Attribution on Attitudes and Attention to Driving Task

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ABSTRACT

Key concerns of automobile interface designers are driving performance and safety. As cars include voices for telematics, command and control, warning messages, etc., these voices become an opportunity to affect drivers and their performance. In this experimental study, participants (N=36) spent 20 minutes in a driving simulator. The car presented randomly interspersed warnings about the driver's performance while they were driving. There were three conditions: Driver blame (e.g., "You are driving too fast"), Driver and Car blame ("We are driving too fast"), or Environment blame ("The road is easy to handle at low speeds"). Results indicate that warnings associated with the environment works best. Drivers felt most at-ease, they liked the system, they rated the quality of the car higher, and their measured attention to the road was better than the other conditions. Implications for in-car interaction systems are discussed.

Author Keywords

Driving simulator, Blame Attribution, Driving Performance, Attitudinal change, Trust and Liking.

ACM Classification Keywords

H.5.2 User Interfaces, H.1.2 User/Machine Systems

INTRODUCTION

Interactive information systems have moved into the car. Most car manufacturers offer in-car navigation systems, and these systems, regardless of whether they use screen-based interactions, speech-based interactions or a mix thereof, will affect the driver's attitude and driving performance.

Screen-based interaction requires the driver's eyes and focus to move from the road to the screen [5, 6]. Attention theory suggests that speech based interactions would be less detrimental to driving than display based interactions [8]. Results, however, indicate that drivers don't necessarily manage their speech-based interaction effectively. Drivers tended to take risks during speech based interactions and they failed to compensate for slower reaction times [3, 4].

Speech based interactions with in-car systems also share many of the characteristics of mobile phone conversation, and may show the same effect on driving performance [7]. Using a mobile phone, part of the driver's attention transfers from the road to the ongoing communication. This, together with the communication partner's lack of knowledge of the driving condition and the driver's current situation, increase the risk of unintentionally creating a hazardous driving situation A recent study on using speech based email in the car confirms previous results on using mobile phones in the car [4].

There are fundamental differences between conversation with in-car computers, conversations using mobile phones and conversations with passengers. There is, however, very little data published on the impact of a conversational interface on a driver's attitude and driving performance. The closest match is the Virtual Intelligent CO-driver (VICO), investigating natural interaction with in-car systems. Preliminary results from this project shows that VICO was distracting and the measured performance exhibits the same properties as when talking on the mobile phone [1, 6].

For this experiment, a Virtual Passenger was introduced as the speech-based interface to an in-car Information System.

THE VIRTUAL PASSENGER

Virtual Passenger

The Virtual Passenger is a voice user interface that has no physical embodiment. It is defined as a set of sentences interacting with the driver. An overall goal of the Virtual Passenger is to identify design criteria for a virtual presence that is both well liked and improves driving performance. The Virtual Passenger used in this experiment was designed to test the driver's reaction to the blame attribution of warning messages.

CHI 2004, April 24–29, 2004, Vienna, Austria.
ACM 1-58113-703-6/04/0004.

The theory of blame attribution looks at how people make sense of their world: what cause and effect inferences they make about the behaviors of others and of themselves [2]. There are two basic kinds of attributions made: internal (dispositional) attributions and external (situational) attributions. People have a tendency to attribute blame for problems to others (external) and to take credit for success (internal).

To study the impact of blame attribution, warning messages were phrased so that blame was attributed to one of three different sources. The "Driver-Blame" source blamed the driver for mistakes, the "We-Blame" source blamed the driver and itself, and the "Environment-Blame" source blamed the environment for all mishaps.

The Driver-Blame Virtual Passenger used sentences such as "You are driving too fast" and "You should slow down when taking these curves." The We-Blame Virtual Passenger used the same sentences simply replacing "you" with "we," viz., "We are driving too fast" and "We should slow down when taking these curves." The Environment-Blame Virtual Passenger would indicate external problems, and used sentences like "This road is easy to handle at slow speeds" and "These curves require slow speed."

Attention to Road and Attitude

While using the driving simulator, the drivers attention to the road was measured based on a "honking task." Subjects were asked to say the word "honk" as soon as they heard a honk. Fast response times to honks were used to indicate high attention to the road and the driving task, while slow response times indicated low attention to the road

The response times were measured during both a silent driving session and a driving session with a Virtual Passenger.

Subjects also assessed their perceived driving performance, attitude towards the in-car system, attitude towards the car, and blame attribution by completing a set of web-based questionnaires.

Goals of the Experiment

We examine drivers' perceptions of the interactions with the Virtual Passenger and the impact on the driving performance to answer three questions:

1. *Does the blame attribution of the Virtual Passenger influence the driver and drivers' attention to the road?*
2. *Does the blame attribution of the Virtual Passenger influence perception of the Virtual Passenger?*
3. *Does the blame attribution of the Virtual Passenger influence perception of the car?*

METHOD

Overview

The experiment was a 3 (blame condition: Driver blame, We blame, Environment blame) x 2 (participant gender) x 2 (order of driving sessions: silent first, blame first), balanced and mixed between- and within-participant design.

A total of 36 adults, 18 male and 18 female, were recruited for the study. All participants had a driver license and the vast majority had experience with computer games. Participants were informed that the study would take one hour and twenty minutes; they gave informed consent and were debriefed at the end of the experiment

Experimental Equipment and Procedure

The driving simulator was based on a PlayStation2 running Gran Turismo 3. It was configured so that all subjects used the same settings. The driving simulator was controlled using two pedals, accelerator and brake, and a force-feedback steering wheel.

The silent driving session was defined as a 10-minute session interspersed with 11 honks. The three variations of the Virtual Passenger were defined as three separate 10-minute sessions with 21 recorded sentences interspersed with 11 honks.

As the first sessions, all subjects watched a relaxing DVD of safe driving practices on a 28" TV for 20 minutes.

After this, each participant was randomly assigned to one of the three Virtual Passengers. The order of the driving sessions was randomized so that 50% of the subjects started with the silent driving session, and 50% started by driving with the Virtual Passenger. There were an equal number of male and female participants in each condition.

During the silent session, subjects responded verbally to generated honks, and during the session with the Virtual passenger they interacted with the Virtual Passenger in addition to responding to the honks. After driving, subjects self-reported on their current status, driving performance, and assessment of the car and the Virtual Passenger

For the third session, the subjects switched so that subjects who had driven in the silent condition would drive with the Virtual Passenger and vice versa. After the session, subjects once again self-reported via questionnaires, and concluded the study by filling in the questionnaire on blame attribution.

Manipulation

The same male voice was used for all three versions of the Virtual Passenger. The difference between the 21 sentences used by the different version of the Virtual Passenger was purely based on blame attribution.

Measures

Actual Attention to Road and Driving Task

Measured driving attention. This was calculated based on the average response times to the honks.

Questionnaires and Scales

The questionnaires were all based on the question "indicate the level to which you agree with the following statements" followed by a list of statements in a 10-point Likert Scale, ranging from Describes Very Poorly (= 1) to Describes Very Well (= 10).

Perceived Alertness was an index created by averaging responses to six statements from the questionnaires: alert, drive carefully, drive safer, happy, confident, feel assured. The index was very reliable (*alpha* = .88).

Blame Attribution was based on a standard scale that asked who was more responsible for a series of hypothetical situations. Participants received one point for each item for which they took personal responsibility.

Liking of Car was an index created by averaging responses to four words from the questionnaires: use, buy, have, recommend. The index was very reliable (*alpha* = .84).

Quality of Virtual Passenger was an index created by averaging responses to six words from the questionnaires: well-designed, intelligent, high quality, friendly, reliable, fun. The index was very reliable (*alpha* = .88).

RESULTS

The effects of the Virtual passenger on the driver's attitude and attention to road was measured by a two-way ANOVA with blame and gender as the between subject factors.

Environment Blame participants had much shorter response times to honks than the other groups, $F(1,30) = 4.62$, $p<.02$. Strikingly, Environment Blame participants were even more attentive to the horn honks than those drivers that did not have a virtual passenger in the car.

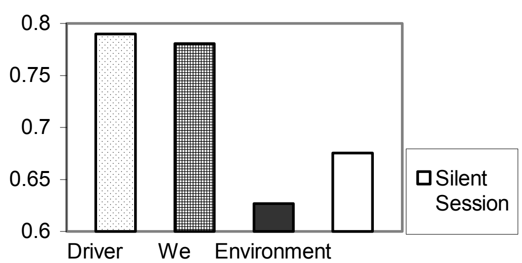

Figure 1: Average response times to honks

Environment Blame and We Blame participants perceived themselves to be more alert than did Driver Blame participants, $F(1,30) = 4.40$, $p<.02$. It may be that the constant blaming of the driver made this last category feel that they were not being attentive enough

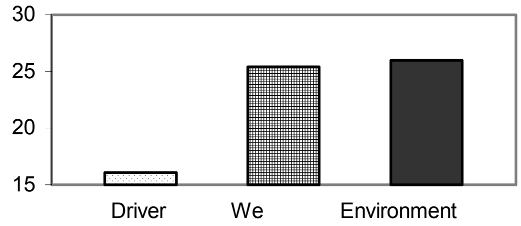

Figure 2: Perceived alertness

The blame manipulation affected driver's perceptions of their generalized responsibility for actions. Environment Blame participants felt significantly more blame than We Blame participants, with Driver Blame participants in the middle, $F(1,30) = 3.21$, $p<.05$ This result is remarkable given that personal responsibility is generally seen as trait that is relatively immutable.

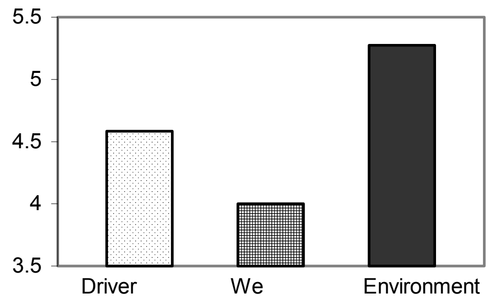

Figure 3: Personal Responsibility

Assessment of Car

Blaming the driver directly had very negative effects on participant's perception of the car. Driver Blame participants clearly liked the car less than either of the other two conditions, $F(1,30) = 5.82$, $p<.01$.

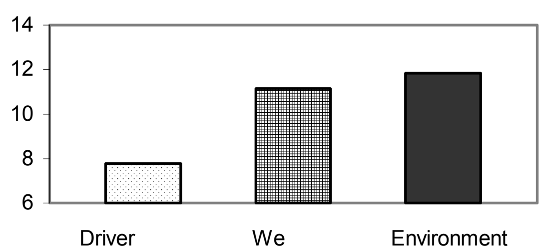

Figure 4: Liking of the Car

Similarly, Driver Blame participants perceived the car to be of much lower quality (well-designed, intelligent, high quality, friendly, reliable, fun) than the other conditions. The Virtual Passenger also influenced the willingness to buy the car. Environment blame participants would buy and recommend the car more than the other groups.

Assessment of Virtual Passenger

The linguistic properties of the Virtual Passenger had a significant effect on the perceived quality of the Virtual Passenger, $F(1,30) = 3.96$, $p<.03$. Environment Blame participants assessed the Virtual Passenger most positively, significantly more so than did Driver Blame participants.

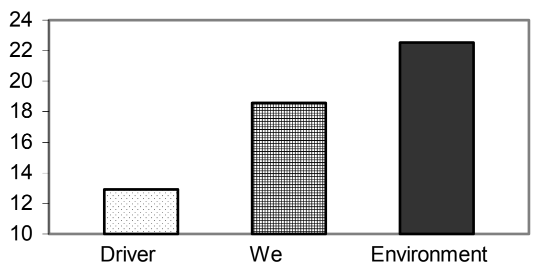

Figure 5: Quality of the Virtual Passenger

DISCUSSION

The results clearly show that blame attribution can be manipulated based purely on small linguistic differences. The most striking results here are that careful selection of language can influence response times to honks. It is also clear that the identity of the car is strongly connected to the voice system. Environmental Blame participants paid much more attention to the road than even individuals who did not have a voice in the car. They were also the only participants to feel high levels of both attentiveness and personal responsibility.

Even though most accidents are caused by driver error, our data indicate that blaming the driver for errors might be an ineffective strategy. This could cause them to pay less attention to the road, and to dislike the car.

The effects of the "we" condition are quite interesting. Obviously, the car is seldom responsible for poor driving, and our hypothesis is that "we" remarks were interpreted as the car attempting to mitigate the effects of criticism.

Future Research

The concept of a Virtual Passenger should be further investigated. Future research should explore paralinguistic and lexical variations of the Virtual Passenger. Research has shown that syntactic structure, gender, ethnicity, emotion, and personality, can influence user responses and the ability to process information.

The current study used unrelenting negative comments. It is important to consider how positive comments (e.g., you're driving well" and "this is a pretty road"), and telling jokes would influence the driver's attitude and attention.

Individual differences such as personality, emotion, drowsiness, etc., are all likely to influence how the driver will react to the Virtual Passenger and the driving task. It is also not clear to which extent the system should be honest. At times, discretion is more effective than honesty and it will be important to identify when the Virtual Passenger should be brutally honest and when it should remain quiet or sugarcoat remarks.

The most glaring deficiency of the current system is that the comments by the Virtual Passenger were randomized and not based on the subjects driving. Using a "real" driving simulator will allow interactions to be scripted based on road conditions and the driver's current situation.

A consistent theme in today's culture is that computers and interfaces cannot lie. They simply respond to the user's performance consistently and objectively; they tell the user exactly what's going on. The current research suggests that that strategy may be flawed: People do not want to always be reminded of their mistakes. With clever and strategic references to all of the different rationales for behavior change, cars and other technologies might dramatically enhance safety while encouraging positive feelings. What more could a designer want?

ACKNOWLEDGMENTS

This research was supported in part by Toyota ITC. We thank the Communication Department at Stanford University for providing space and facilities.

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