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How Effective an Odd Message Can Be: Appropriate and Inappropriate Topics in Speech-Based Vehicle Interfaces

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Abstract

Dialog between drivers and speech-based vehicle interfaces can be used as an instrument to find out what drivers might be concerned, confused or curious about in driving simulator studies. Eliciting on-going conversation with drivers about topics that go beyond navigation, control of entertainment systems, or other traditional driving related tasks is important to getting drivers to engage with the activity in an open-ended fashion. In a structured improvisational Wizard of Oz study that took place in a highly immersive driving simulator, we engaged participant drivers (N=6) in an autonomous driving course where the vehicle spoke to drivers using computer-generated natural language speech. Using microanalyses of the drivers' responses to the car's utterances, we identify a set of topics that are expected and treated as appropriate by the participants in our study, as well as a set of topics and conversational strategies that are treated as inappropriate. We also show that it is just these unexpected, inappropriate utterances that eventually increase users' trust in the system, make them more at ease, and raise the system's acceptability as a communication partner.

Introduction

In experimental settings within automotive simulators, establishing dialog can not only allow designers to prototype speech interfaces for automobiles, but also can be used as an instrument, to find out what drivers might be concerned, confused or curious about during the course of an drive. The use of driver-vehicle dialog is, in some ways, a variant of the think-aloud protocol (Ericsson & Simon 1984) championed by usability experts such as Jakob Nielsen (Nielsen 2002). We analyzed several trials of an automotive simulation study where this driver-vehicle conversational protocol has been used to better understand aspects of autonomous driving such as transfer of control or response to imperfect driving. We utilized various conversational strategies—including revealing personal information, or asking the partner's preceding question—and observed their resulting effect on the conversational direction. We found that the *topics* for dialog introduced by the car had a strong effect on participants' responses and engagement.

Figure 1: Participant vocalizes his fear (left) and covers his eyes (right) as the car drives off of the road.

It can be challenging to infer what people are expecting or thinking when they are interacting with a speech-based system, because their use of the system precludes the use of other concurrent verbalization techniques. However, by using a Wizard of Oz protocol (Dahlbäck 1993) with our speech system, the simulated system is able to participate in contingent communication (Gerber 2007) and thus to engage the driver in open-ended dialog about his or her thoughts and ideas, experiences, emotions and perceptions. In addition, users' linguistic behavior itself is a resource for identifying their understanding of their artificial interaction partner (Fischer et al. 2012).

Study Methodology

The study took place in an immersive automobile simulator. We recruited six participants who were experienced in creative verbal and physical expression. Participants were instructed only that they should "*interact with the car*." The car greeted them and provided an outline of the task ahead: they were driving to the airport, a 30-minute trip. On several occasions, the car asked if participants would like to enable or disable automation, and if the drivers agreed, the car guided them through a structured handoff.

During the drive, the car engaged participants in conversation. At first, these exchanges centered on topics such as trip progress, navigation and driving characteristics, but along the way they transitioned to more personal topics, such as the driver's wellbeing, preferences and daily activities, with the car becoming more disclosive in return.

The methodology used in this study is based on ethnomethodological conversation analysis (Sacks 1996; Sacks, Schegloff, Jefferson 1974), a micro-analytical approach to the analysis of interactional data which takes utterances not to *mean* anything by themselves; instead people need to negotiate and ratify these meanings, which leaves traces in the sequential structure of interaction that are available for analysis.

Conversation Analysis

An analysis of the topics of the first ten initiations (first pair parts of adjacency pairs produced by the users, Levinson 1983) in the six interactions under consideration shows that expected topics, and topics deemed appropriate for an interaction with a car, concern the following aspects:

- navigation 1.2%
- driving and control (requests for or feedback concerning autonomy) 60%
- information about places, restaurants, car rental, speed limit, etc. 1%
- feedback on the simulation 18%

In contrast, topics initiated by the system that are treated as unacceptable comprise:

- requests for feedback
- personal topics
- perceptual informings

Initially, participants treat the car's spoken dialog system as an extended navigation system, rather than a conversational partner. But their perceptions change over the course of the simulation, so that by the end of the trip, they engage in rich social dialogs, and raise topics that go beyond conceptualization of the system as purely navigational. For example, the following shows how participants react to a request that deemed as inappropriate:

1: Car: so, I notice that one of my tires is low. is there something about yourself that you want to talk about?
2: (2.0)
3: P1: ((laughs out loud)) that's the most bizarre question I've ever heard from a car, (4.5) do we need to go for maintenance now or can we make it to the airport?

Excerpt 1

The participant replies after two seconds, whereas usual response time in conversation is 300 msec. Silence of more than a second usually indicates an upcoming negative, dispreferred response; that is, potentially socially unacceptable.

Responses also suggest that topics that are initially treated as unwelcome or inappropriate, especially those concerning perceptions of human behavior, eventually lead to increased confidence in, and comfort with, the system:

1: P2: cause' it seems like you're doing okay.
2: P2: and there's no traffic.
3: (5.0)
4: Car: do you trust me that well already?
5: Car: thank you.
6: Car: what have I done to earn the trust?
7: (0.3)
8: P2: ↑uhm↑ (.) no accidents or no (0.5) uh (0.5) movements (.) a:nd
10: (2.0)
11: P2: when you saw that person behind a tree, it's pretty impressive.

Excerpt 2

Discussion

The current findings indicate drivers' expectations regarding verbal interactions with autonomous cars as well as how these expectations change over the course of relatively short interactions based on the conversational behavior of the system. Thus, users can be guided into a different understanding of the system and its capabilities—and in the current case also into a more pleasant driving experience.

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