

Connectivity and communication in the car becomes more and more important. In order to minimize distraction, car manufacturers are introducing speech-enabled interfaces to messaging (email, SMS) and Internet services. Apple's Siri is one of the most popular systems also for cars, utilizing screen mirroring functions or other direct ways to integrate the mobile phone application. We claim, however, that this is not enough for being safe. The main objective of the research project GetHomeSafe (2012-2014) under the 7th Framework Programme of the European Commission (grant agreement no: 288667) was to investigate ways for a deeper integration of interactive, speech-based systems. Therefore, Daimler (Germany), KTH (Sweden), IBM (Czech Republic), Nuance (Belgium), and DFKI (Germany) partnered up to let people "get home safe".

We developed an integrated speech-enabled system for hotel booking, facebook, and Wolfram Alpha in three languages: English, German, and Czech. It features Nuance's latest hybrid speech recognizer processing speech partly in the car and partly on a server, depending on the availability of a broadband Internet connection. The possibility to interrupt the dialog when the driving situation requires full attention of the driver, and resume it later is one of the main features of the system for enhancing safety. The interruptions can be user-initiated or system-initiated. In the first case, the driver says "hold", "wait a second", or a similar command. When the system detects a dangerous situation, it interrupts the dialog automatically and notifies the driver accordingly.

Daimler evaluated two main dialog concepts: Command-based dialog vs. conversational dialog. They found a strong correlation between CER (command error rate) and usability respectively visual distraction. However, the speech dialog strategy had no influence on driving performance. Furthermore, the following GUI variants were compared: Without GUI, with GUI, with GUI and avatar. The users preferred the GUI but not the avatar. The avatar did, however, not negatively influence the driving performance.

As a result of Working Package 3 (Human-like Proactive Behaviour), KTH came up with the following results: In studies on Human behaviour it was found that short attention-grabbing phrases (like cough or "uh-hum") is rarely ever used. Instead, humans use full phrases. In high-urgency cases, if the system knows that the driver must accept the invitation to speak, the matter should be included in the first sentence. In low-urgency cases, the system should explicitly ask if now is a good time to speak, and include a general task description. Counter to our prior assumptions, it is reasonable to use full utterances for attention grabbing. Drivers are likely to interrupt if they reject initiating the dialog while they are likely to wait until the system is finished if they accept it. For internal or external interruptions, it was found, that the system should pause within 500 ms. The position in speech is not crucial, but it is preferred if happens at the end of a sentence. False internal interruption may be filled with pauses and slow speech. After short (wrong) interruptions, the system should resume at the same place,

repeating the interrupted word. After long (subtask) interruptions, the system should resume from the beginning of the utterance and add an initial filled pause, optionally followed by a discourse marker (“yeah”, “okay”).

The final GetHomeSafe system is fully integrated in a Mercedes car and provides the following other features: natural language support plus slot-by-slot filling depending on the user’s choice, barge-in, and pro-active behaviour.

The final evaluation of the GetHomeSafe prototype was done in a real car on a training center. We were able to show the improvement in terms of driving safety as well as user satisfaction compared to the baseline of using a touch-based system.

In addition to that, the project GetHomeSafe delivered the open-source driving simulator OpenDS together with ready-made driving tasks for studying the distraction of interactive systems in the car.

The Continuous Tracking and Reaction Task (ConTRe Task) is a highly controlled driving task that allows fine-grained measurement of steering and event detection performance through very few dependent variables. We developed a task that resembles following a curvy traffic way, with a lead vehicle braking and accelerating from time to time. Moreover, crossroads traffic or other peripheral events occur from time to time. Our goals were: creation of a highly controlled driving task; fine-grained measurement of steering and event detection performance (few dependent variables); adaptability of driving task difficulty and event rate (several levels, even on-line manipulation) to enable assessment of moderating effects of driving task difficulty (workload).

The Three Vehicle Platooning Task (3VPT) is a more realistic driving task and allows measuring many different dependent variables, but is still controlled. It demands the driver to control his lateral as well as longitudinal position and additionally to detect and respond to several events. The main idea behind the development of the 3VPT was to create a driving scenario that approximated real driving in a superior way than the ConTRe task. Therefore, the question was which aspects of real driving could have been underrepresented in those previous driving tasks and how an alternative scenario could look like. These thoughts included realism of the environment, occurring events and stimuli, unpredictability of these events on the one hand and the variation of the actual driving speed and keeping an appropriate safety distance on the other hand. Also, like for ConTRe, there should be the possibility to vary the scenario for different applications.

OpenDS (www.opens.eu) has become an acknowledged international brand in driving simulation. It is used by a large number of researchers world-wide. The GetHomeSafe driving tasks are used and

cited by numerous scientific studies ever since. By the end of the project GetHomeSafe, we published released 3.0 of the software. It already contained packages from external developers.