Voice Search While Driving: Is It Safe?

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Abstract

PowerPoint presentation.

Voice Search 2009
Voice Search While Driving
Is it Safe??

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Voice Search 2009
San Diego, California
Innovative mobile applications

Courtesy of Bruce McCall
Innovative mobile applications for the car

- Now 275 car models have iPod connectors 5 years ago: 0 models*
- Models with DVD entertainment systems have doubled in 5 years*
- Nav systems, customizable environment settings, Bluetooth, satellite radio, messaging, web access,…
- Over $12B will be spent on electronic enhancements for vehicles in 2008**

But, by the way, is this safe?

*NY Times Cars Special Section, October 30, 2008
**CEA Industry Forecast, November, 2008
Eye movements operating an iPod while driving

Video courtesy of Donald Fisher, HPL, U. Mass. Amherst
Speech interfaces to the rescue!
Eyes free (mostly)! Hands free (mostly)!

- Command & control
- Music selection
- News & information control
- Voice call setup
- Destination entry
- Point of interest finding
- Dictation and voice output for email and text messaging
- …

But, are voice interfaces really safe?
Are they all the same?
Areas of Concern

- **Stateful language dialogs**
  - Only a subset of commands available
  - Does the user know what to say?
  - What if the system fails to understand?
  - What if the system state doesn’t correlate with the user’s intentions?

- **System-paced dialogs**
  - The system prompts the user, waiting for a response
  - What if the user needs to attend to driving?
  - An additional distraction from the road?
Dialog-based Music Finding

Commercially available system
Voice search (Speech-in List-out) alternative

- Stateless language dialogs
  - All commands always available
  - User may say anything
  - Only failure is unsatisfactory result—try again
- User-paced
  - The system never prompts the user
- Speech used only when needed
  - Haptic input for list navigation, state selection, etc.
Voice Search Music Finding

MERL’s SpeakPod prototype
Testing the hypothesis

• Collaboration with U. Massachusetts Human Performance Laboratory (D. Fisher, Director)
  • Driving simulator
  • Eye tracker
Three conditions for finding music while driving

<table>
<thead>
<tr>
<th></th>
<th>Display</th>
<th>Haptic Interface</th>
<th>Secondary Input Modality</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. iPod</td>
<td>2.5-inch LCD</td>
<td>click-wheel</td>
<td>none</td>
</tr>
<tr>
<td>B. Commercial aftermarket in-dash unit</td>
<td>7-inch LCD</td>
<td>wheel-mounted remote</td>
<td>speech (dialog-based)</td>
</tr>
<tr>
<td>C. MERL SpeakPod prototype</td>
<td>7-inch LCD</td>
<td>wheel-mounted remote</td>
<td>speech (query-based)</td>
</tr>
</tbody>
</table>
Experimental procedure

• 17 native English speakers (12 men, 5 women) from students and staff of U. Mass.
  – Ages 18 to 30 (average 21.5)
  – iPod experience

• Music retrieval task (finding a specified item)
  – Specified song
  – Any song from specified album
  – Any song from specified artist

• Simulated driving task (4 different blocks per user)
  – Eye movements monitored
  – Music retrieval tasks timed and marked successful or not
Task success rate

- iPod
- Dialog-based
- SpeakPod
Task time completion

- iPod
- Dialog-based
- SpeakPod

Seconds per Task

50
45
40
35
30
25
20
15
10
5
0
Average glance time away from the road

- iPod
- Dialog-based
- SpeakPod

Average glance time away from road

Seconds per task
Conclusions

• Myriad of new features and gadgets compete for driver’s attention
• Ultimate user experience must include safety!
• Speech interfaces are a good direction
• However, different UI dialog models may influence safe driving
  – Stateful dialogs, system pacing
  – Stateless dialogs, user pacing
• Initial experiment
  – Some support for hypothesis
  – Need for further testing and research
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  – MERL: Garrett Weinberg, Bent Schmidt-Nielsen, Bret Harsham, Cliff Forlines

Further Information

• http://www.merl.com/projects/SpokenQuery