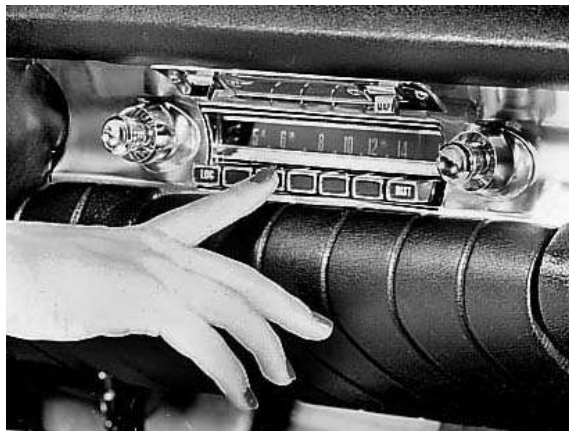


Trends in Automotive User Interfaces



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A Cross Country Automotive Services Company

Agenda



- » Automotive speech technology
- » Voice dialing
- » Navigation control
- » Embedded versus off-board
- » Mobile device functionality
- » What to expect in the future

Car Speech Technology



- » What are the challenges?
- » Meeting the driver's expectations
- » What should be speech enabled?
- » Safety – minimizing driver distraction

Challenges that linger.....



» User adoption

- Analogous to pairing bluetooth phones - optional

» Knowing how to use speech in the car

- Is it really easy for most people?

» Accuracy

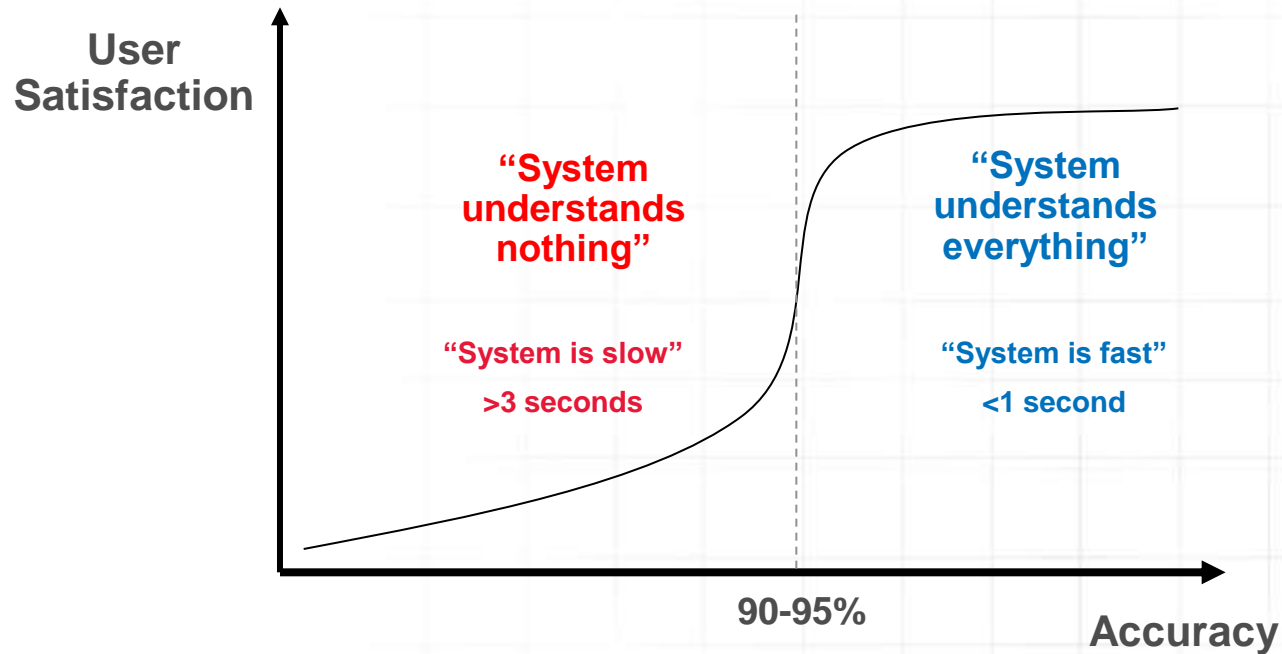
- Knowing what to say and how to manage results

» Dependency on vision and touch

- No exceptions even today
- Single button from steering wheel - ideal

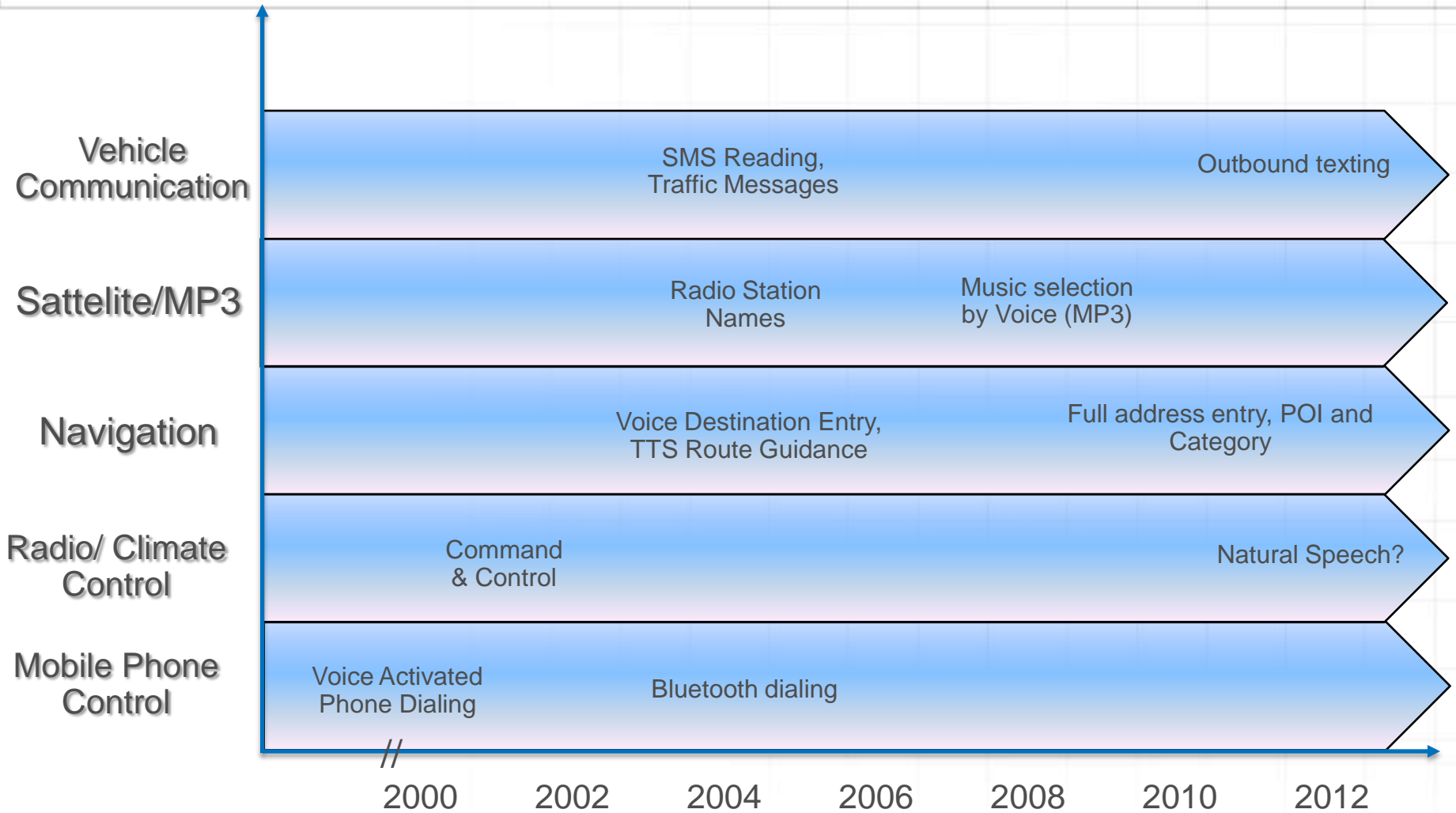
» Mobile device usage influences

Latency, Accuracy & User Satisfaction



System Latency and Accuracy are both critical for user satisfaction

Evolution of Speech in Automotive



Introduction to the Market



Early Voice Dialing



- » First embedded systems were prototyped in the 80's
- » First off-board automotive dialers were deployed in the early 90's
 - Discrete digit dialing
 - Name dialing
 - Connect time was an issue
- » Driver distraction acknowledgement
- » Advent of DSP-based mobile phones

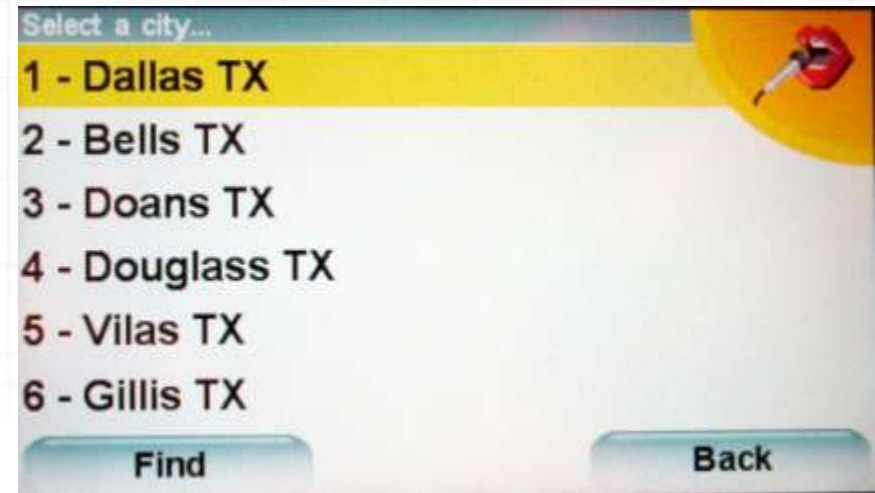
Portable Navigation: TomTom example



- Must initialize with tap
- Optional dialog mode
- Speech is very effective



- N-best lists are critical
- Confirm by tap or voice



Speech-enabled Navigation



- » Basic control and destination entry
- » User interface challenges
- » Off-board advantages
 - Current map data and other dynamic content
 - Head unit versus off-board turn-by-turn
- » PND market trends
 - Speech recognition has arrived and is well received
- » Common to have speech-enabled destination entry
 - POI coverage
- » Trends in speech capabilities

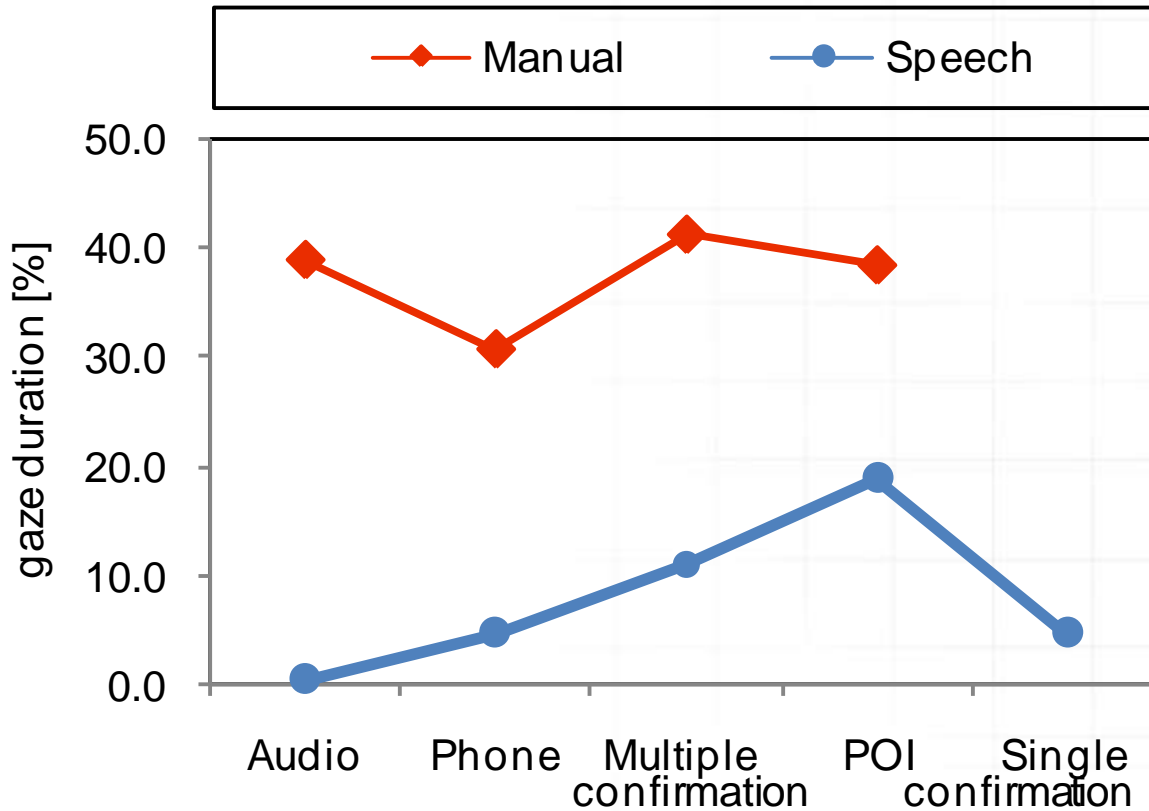
User Interfaces that depend on vision



RL Steering Wheel Control Buttons



Drivers Keep Their Eyes on the Road



- When controlling in-car systems manually car drivers focus their eyes on the devices instead of the traffic for 30 – 40 % of the duration of the task
- Music selection by voice almost eyes-free
- Voice dialing or entering a destination by voice reduce distraction to less than 10 %.

2008 Technical University of Braunschweig, Nuance

Speech Interfaces in the Vehicle



- » Trends in mobile device usage while driving
 - Increased need for speech-enabled text entry
- » Multimodal interaction modes
 - Speech, hearing, vision, and touch
- » Next generation technology allows voice search
- » Increases safety, productivity, and entertainment

- *Mixing a vision with speech is complex while driving*
- *HMI principle: ability for vehicle driver to glance*
- *Latency and reliability are key to usability*

Embedded Versus Off-board



» Embedded Technology

- Speech within the application environment
- Some limit on computing resources
- Limited usability and adaptation
- Direct audio input
- Push-to-talk: various methods for users to learn

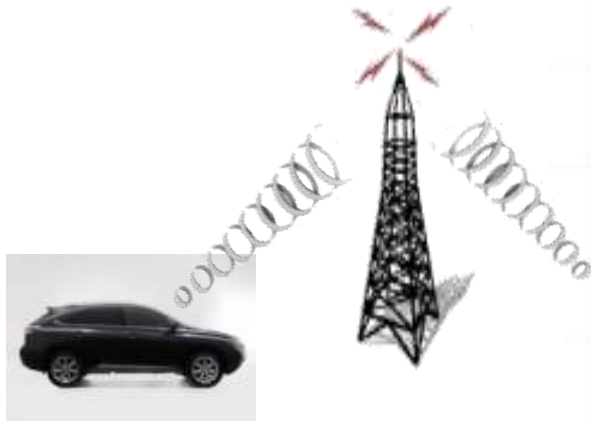
» Off-board Technology

- Speech outside the application environment
- Unlimited computing resources
- Unlimited usability and adaptation
- Distorted audio input (over wireless voice channel)
- Push-and-wait-to-talk (essentially, an outbound call)

Speech in the cloud for the vehicle



The Driver



Key Benefits:

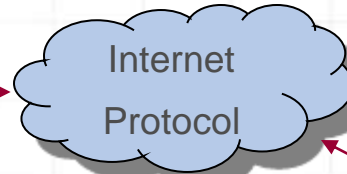
- Controlled accuracy
- Technology agnostic
- Multimodal UI
- Multi-lingual

Enterprise Data Center

Multi Modal Platform



- Dialog Controller
- Media Gateway
- Multimodal Services



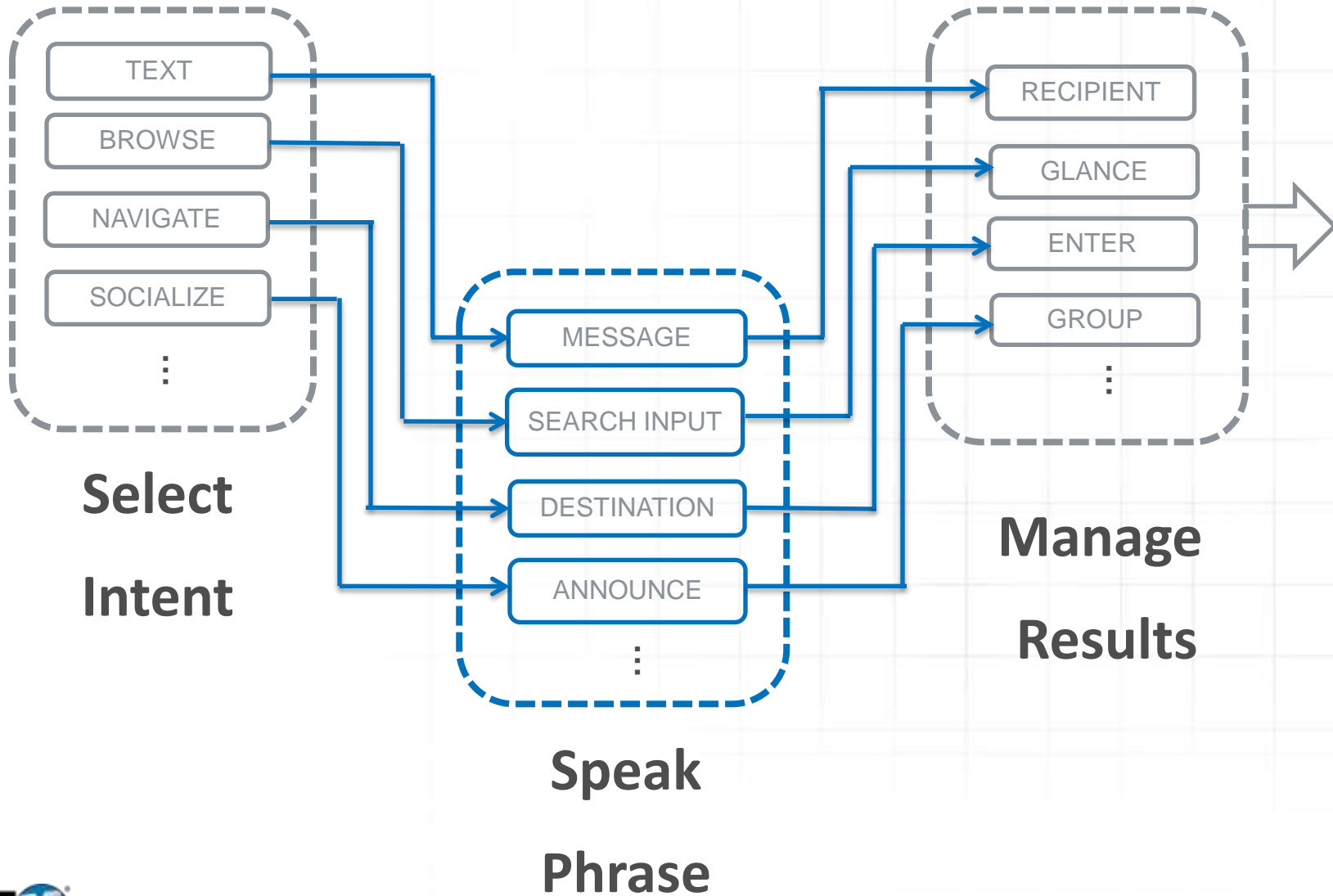
Entering text while driving



- » Browse by voice
 - Speak search phrase and see search results
 - Limited value in the vehicle
- » Text by voice
 - Speak text message and send it
- » Advanced destination entry
 - Speak business name, category, or full address
 - Local search leverages vehicle location

Speech in the cloud: advanced processing

HMI methodology for text input



CONCLUSION: Challenges and Trends



- » Consistent accuracy and natural language
 - Flexible dialogues, avoid voice menus
- » Avoiding driver distraction
 - Simplicity and “the right” applications
- » Convergence of embedded and off-board
 - Consistent user experience
- » Voice browsing, text-by-voice, improved destination entry
- » Mobile device HMI controlled by vehicle
 - Key trend for future navigation and infotainment



» CONNECTED VEHICLE SOLUTIONS

Questions?



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