

# Voice in the Vehicle: The Next Frontier

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# In 2015 and 2016, I said...

Speech recognition in the car is:

- 1) Motivated by safety (hands-free)
- 2) Designed by automotive companies

I also said:

- Keep it simple
- TTS and on-screen sync
- Minimize glance time
- Use multi-modality



# Driver Distraction



# According to JD Powers:

- 19% of OEM GPS navigation users were unable to locate a desired menu or screen
- 23% had difficulty with voice recognition
- 24% claimed that their devices provided incorrect routes.

*“...high level of integration makes them incredibly convenient, but it has also led to usability issues. According to a study performed by J.D. Power and Associates, most consumer complaints about OEM navigation systems are related to ease of use.”*

Source : Lifewire, October 16<sup>th</sup> (<https://www.lifewire.com/oem-infotainment-systems-navigation-534746>)



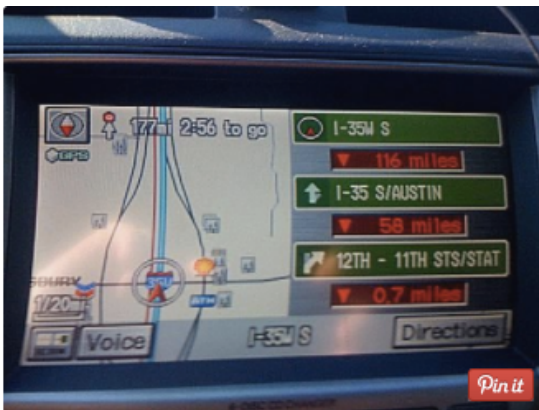
UVO systems include both touchscreen and physical controls. Photo courtesy of Kia Motors America



BMW's iDrive is an example of a highly integrated OEM GPS system. Photo © Jeff Wilcox

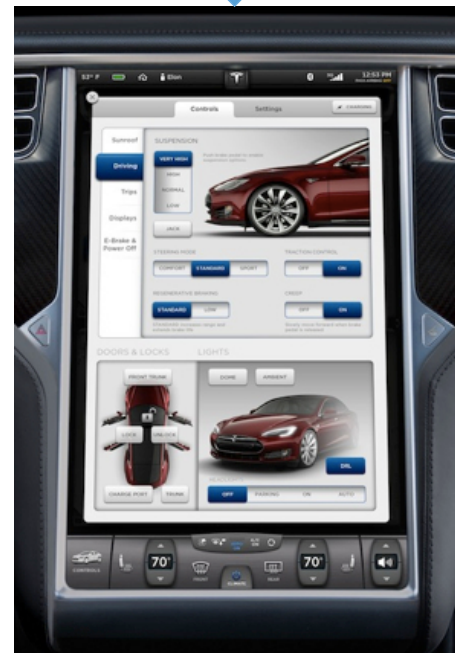


Toyota uses integrated GPS navigation systems. Photo © Willie Ochayaus



Integrated GPS navigation in a Honda Accord. Photo © Travis Isaacs

# Tesla



# Since then...

## Tesla Autopilot 2.0

The first phase of Enhanced Autopilot features...

We've designed these new Autopilot features to give you more confidence behind the wheel, increase your safety on the road, and make driving in traffic less frustrating. Similar to the autopilot function in airplanes, you need to maintain control and responsibility of your vehicle while enjoying the convenience of Autopilot in Model X.

These features operate on a new hardware and software platform. Therefore, their rollout will be measured and cautious until we have generated confidence across several hundred million miles of real-world usage. Enhanced Autopilot will become better over time as this experience is gained and corner cases are addressed. In the meantime, it is particularly important that you remain vigilant and in control when using driver assistance features.


Please refer to the Owner's Manual for more detailed information about these features.

You can email your feedback to [AutopilotFeedback@tesla.com](mailto:AutopilotFeedback@tesla.com).

### Forward Collision Warning

A new active safety feature, Forward Collision Warning, is available with this release. This feature will warn you when there is an object in your path and a collision is likely unless you take corrective action.

A Forward Collision Warning will sound a chime and highlight the vehicle in front of you in red in the instrument panel.



## "Traffic-Aware Cruise Control (Beta)"

COLLISION AVOIDANCE ASSIST. This feature is enabled by default. Any changes to this setting will be saved in your driver profile.

### Traffic-Aware Cruise Control (Beta)


With this release, Model X cruise control has been upgraded to Traffic-Aware Cruise Control. When Traffic-Aware Cruise Control is engaged, Model X will adjust its speed based on the car directly in front of you, decelerating and accelerating as needed up to the set speed.

#### Operating Traffic-Aware Cruise Control

The Traffic-Aware Cruise Control set speed is displayed in the instrument panel to the left of the driving speed. Engage cruise at this set speed by pulling the cruise stalk toward you briefly and releasing.

The Traffic-Aware Cruise Control indicator will turn blue, indicating that cruise is engaged and actively maintaining the set speed. Traffic-Aware Cruise Control also adjusts the driving speed as appropriate when entering and exiting curves.

You can accelerate at any time when using Traffic-Aware Cruise Control. But when you press the accelerator, Model X returns to the set speed.



Source: Teslerati, <http://www.teslarati.com/firmware-8-0-2-50-185-autopilot-2-0-release-notes/>

# Connected Car Industry

- Connected vehicles will outpace population growth for the next decade.<sup>1</sup>
- IHS Automotive forecast: 152 million actively connected cars on global roads by 2020.
- Opportunities to improve safety, convenience, customer experience, quality of life.

Source: <http://bigdatanomics.org>, November 2016 and <http://sas.com> whitepaper: "The Connected Vehicle: Big Data, Big Opportunities"



# Voice Technology Works

- Advances in hardware and software have revolutionized speech technology over the past 2-3 years
- Higher accuracy (ASR) and natural language understanding (NLU) have improved ***the way we speak to machines***
- *“Voice = Should Be the Most Efficient Form of Computing Input”<sup>1</sup>*

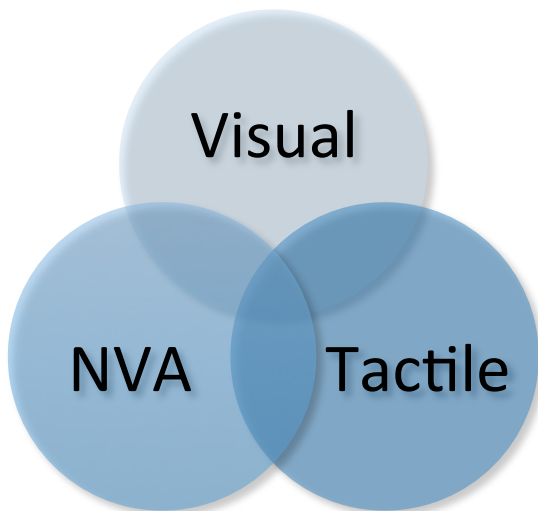
<sup>1</sup>Source: 2016 Internet Trends, Mary Meeker

# When ASR & NLU Work...

- Opportunities arise for great conversational design
- Examples:
  - *Context-awareness*
  - *Smarter help behavior*
  - *Real-time correction*
  - *Deep personalization*

# What is the best UX?

- The optimal user interface is easy AND enjoyable to use, a.k.a “sticky”
- Use other modalities as appropriate, such as:



**Visual:** *photos, illustrations, text and lights*

**NVA** (Non-Verbal Audio): *music, earcons*

**Tactile:** *touch, vibrations*

# Advanced Topics

<p><b><i>Natural TTS (text-to-speech)</i></b> Create your own voice Tune intonation for target audience</p>	<p><b><i>“Wake word” vs. push-to-talk</i></b> “Alexa”, “Hey Siri”, “Ok Google” Do you want/need 100% hands-free?</p>
<p><b><i>Voice Biometrics</i></b> Securely identify each speaker Catch fraudsters</p>	<p><b><i>Emotion Detection</i></b> Monitor user engagement How are users responding?</p>

# Thank You

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