



Back to the Future: The Personal Assistant of Tomorrow

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Speech Understood

Stay If You Want to Learn About



- The origins of voice search as part of personal assistant
- Directional forces driving integration of voice in personal assistants
- Challenges to better mobile voice search
- Where speech technologies are evolving

“Directional” History of Personal Assistants

<u>PDA</u>	<u>Smartphone</u>	<u>Smarter phone</u>	<u>Personal Asst</u>
Touchscreen	Virtual Keyboard	Multi-touch Displays	Contextually Aware
Few Buttons	External Keyboard	Common OS	App Proliferation
Calendar	Handwriting Reco	Easy Sync	Cloud sync
Address Book	Stroke Reco	Wireless Connectivity	App Connectivity
Calculator	Infrared	Bluetooth	Speech Composition
Memo Pad	Wired Connectivity	Phone Integration	Wired Data
Stylus	Memory Cards	GPS	Biometrics
		Speech Recognition	
1993	2002	2007	2013
Apple Newton Palm Pilot	Palm Trio Blackberry Win Mobile	iPhone HTC H2 Android	iPhone 5 Galaxy S3 Nina
	Nuance Voyager TellMe Portal	Google Voice Siri Vlingo	In-Call Apps Dictation

Selected Voice Search Efforts

Application	Distinction
Voyager	Enabling the “Voice Web” with menu driven applications
Nuance In-Car	Navigation, mobile hands-free models
TellMe	Consumer-oriented retrieval of structured information, director search (800-555-tell)
Goog-411	Google Voice local search (2007)
800-free-411	Phone directory with in-line ads (Marchex)
Goog-411	Google Voice local search (2007)
Google Voice	Optimized voice search based on web queries
Siri	One tier context-based search on device and in the network

Broadening Definition of Voice Search in PA



- Voice search now encompasses more than just web queries to finding a variety of information without regard to location or domain
- Context and AI provide constraints that improve recognition
 - Geo-fencing
 - On-device application data
 - “Big Data” connecting social networks
 - User adaptation (grammar, behavior)

Cloud/Device Convergence in Speech Apps

Network/Server-based Speech

Cloud Computing

Constrained Options
Proprietary
Targeted Purpose
Walled Data

Enterprise Applications
Notes & Dictation
In-call Applications
Speaker Verification

Siri

Command & Control
Rendering (TTS)
Ltd. Grammar Recognition
Word Spotting

“Big Data” Access
Offload Processing
Behavior Awareness

Voice Search
Personalized Inquiry
Location Aware Services
Big Data Interactions
Layered Security

Trusted Intermediary
Manage Apps
Situational Awareness

Emerging Channel
Diversity
--Mobility
--Modality
--Motivation
--Business Model
--Technology

Phone

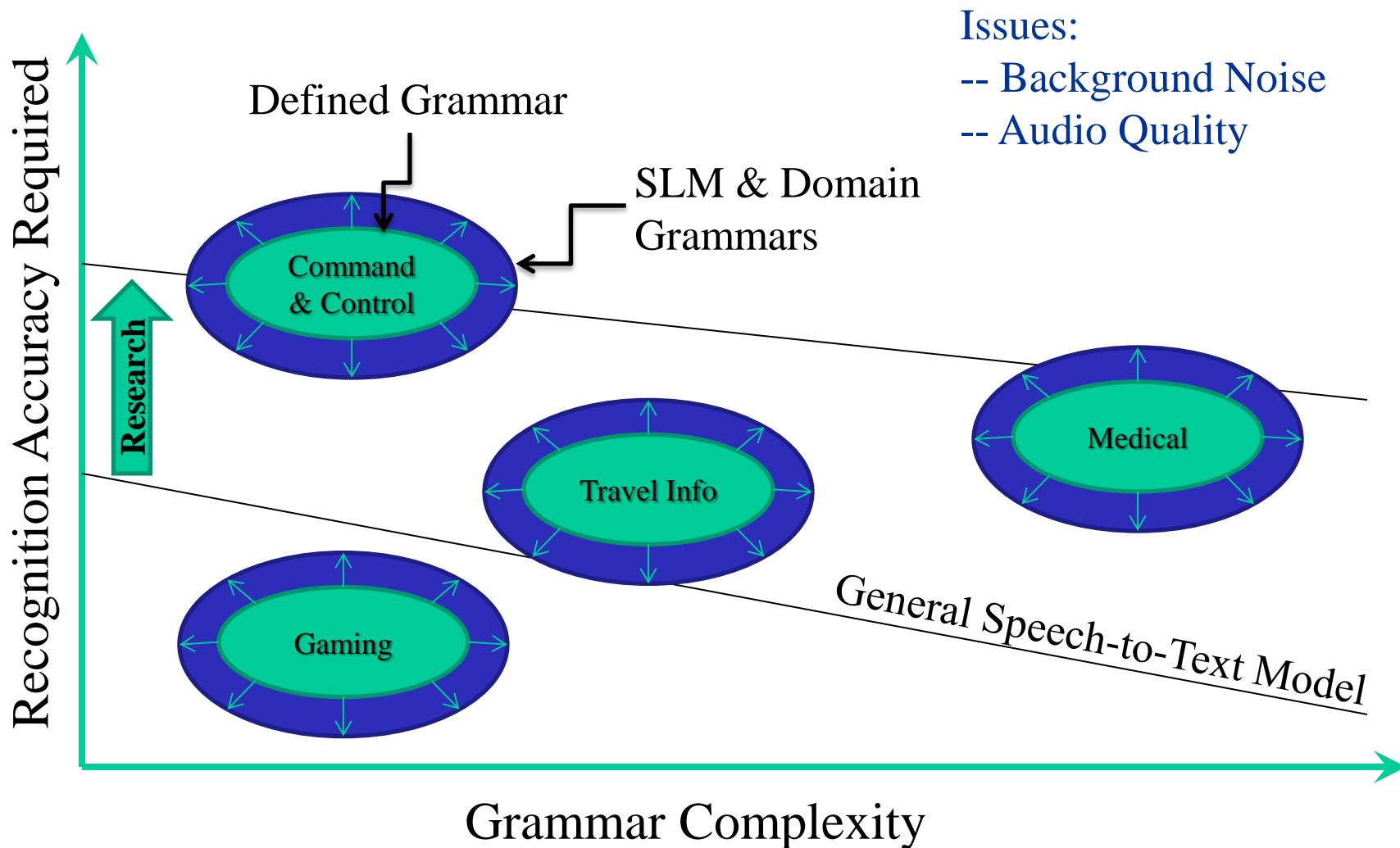
Smartphone

Personal Assistant

Challenges to Broadening Voice Search

Challenge	Solution
Ubiquitous Mobile Connectivity	Matter of user demand and investment
Sharing Big Data	Moving from proprietary domain to shared connections – driven by social networks and convenience
Privacy/ Identity/ Trust	Increasing use of active and passive voice verification even for non-voice search
Computational Efficiency	Speech recognition at the device, app, and network level, depending upon the task, tools and integration
Speech Recognition Engines	Evolving technologies and models possible due to exponential increase in data

Trends Favorable for Voice Search on the PA



Improving Voice Search



- Still room for major strides
 - Data for better acoustic models (e.g., higher sampling rates, lots of transcribed data)
 - Adaptation to user voice (seldom today)
 - Context and behavior adaptation (better define grammars)
- Tuning applications in deployment still count
 - Few great tuning tools (most proprietary)

Voice Search and the Personal Assistant Tomorrow?



- Mobile Voice Search will be seamless access to retrieve what the user seeks regardless of location
 - Most voice search assistants are behavior learning tools today
 - More data, enabling platforms, and tools will lead to more tailored domain grammar models
 - General domain speech models will improve this capability over time