

CHAPTER 9: Expressive Human and Command Languages

*Designing the User Interface:
Strategies for Effective Human-Computer Interaction*

Sixth Edition

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Expressive Human and Command Languages

Topics

1. Introduction
 2. Speech recognition
 3. Speech production
 4. Human language technology
 5. Traditional command languages
- Introduction

Introduction

- The dream of speaking to computers and having computers speak has long lured researchers and visionaries
- Arthur C. Clarke's 1968 fantasy of the HAL 9000 computer in the book and movie *2001: A Space Odyssey* has set the standard for performance of computers in science fiction and for developers of natural language systems
- The reality is more complex

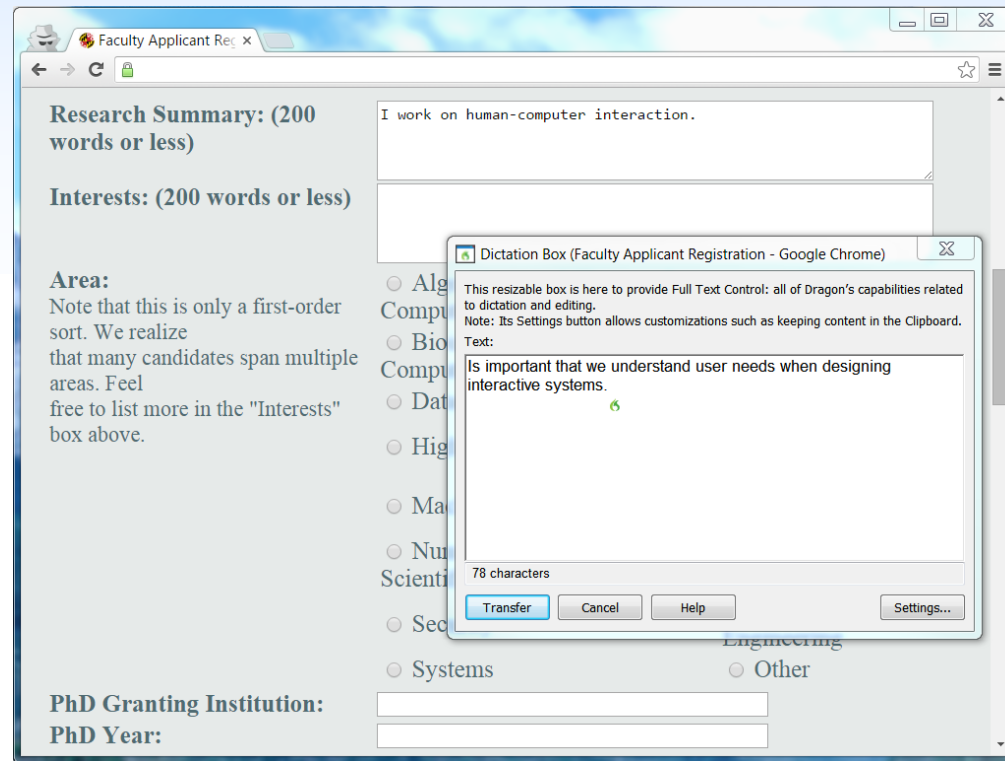
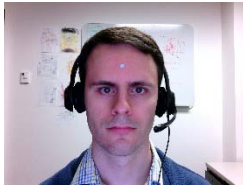
Speech Technologies

- Store and replay (museum guides)
- Dictation (document preparation, web search)
- Close captioning, transcription
- Transactions over the phone
- Personal “assistant” (common tasks on mobile devices)
- Hands-free interaction with a device
- Adaptive technology for users with disabilities
- Translation
- Alerts
- Speaker identification

Speech Recognition

- The place for spoken interaction
- Speech recognition applications
- Designing spoken interaction
- Spoken prompts and commands

Spoken Interaction



- Using Nuance Dragon™ speech dictation and a head mouse (as made visible by the little silver dot on his forehead), a computer scientist is able to overcome a temporary hand disability (<http://www.nuance.com/dragon/index.htm>)

Speech recognition and generation: opportunities

- When users have physical impairments
- When the speaker's hands are busy
- When mobility is required
- When the speaker's eyes are occupied
- When harsh or cramped conditions preclude use of a keyboard
- When application domain vocabulary and tasks is limited
- When the user is unable to read or write (e.g. children)

Speech recognition and generation: obstacles to speech recognition

- Interference from noisy environments and poor-quality microphones
- Commands need to be learned and remembered
- Recognition may be challenged by strong accents or unusual vocabulary
- Talking is not always acceptable (e.g. in shared office, during meetings)
- Error correction can be time consuming
- Increased cognitive load compared to typing or pointing
- Math or programming difficult without extreme customization

Speech recognition and generation: obstacles to speech production

- Slow pace of speech output when compared to visual displays
- Ephemeral nature of speech
- Not socially acceptable in public spaces (also privacy issues)
- Difficulty in scanning/searching spoken messages

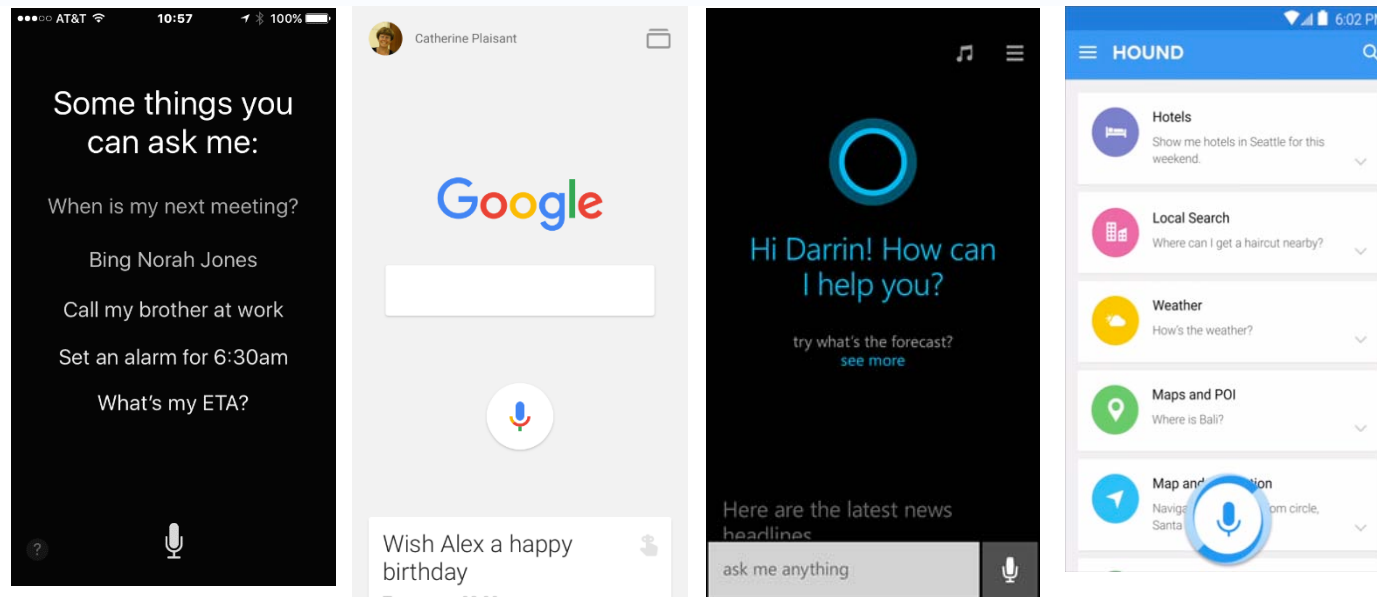
Voice-activated Digital Assistants

- A few years ago, you would only see someone talking into their phone if somebody was on the other side
- Fast forward a bit and now talking to your phone when you are not on a call is no big deal
- Siri for iPhone revolutionized the behavior, and nowadays it is common to see people use their voice to control their phones

Designing spoken interaction

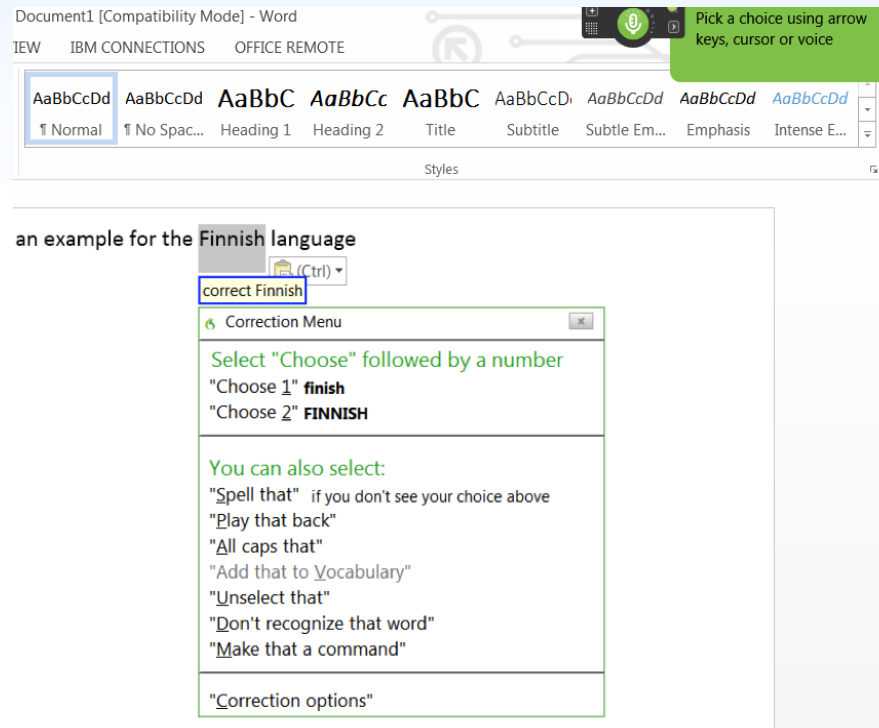
- Initiation
- Knowing what to say
- Recognition errors
- Correcting errors
- Mapping to possible actions
- Feedback and dialogs

Designing spoken interaction (continued)



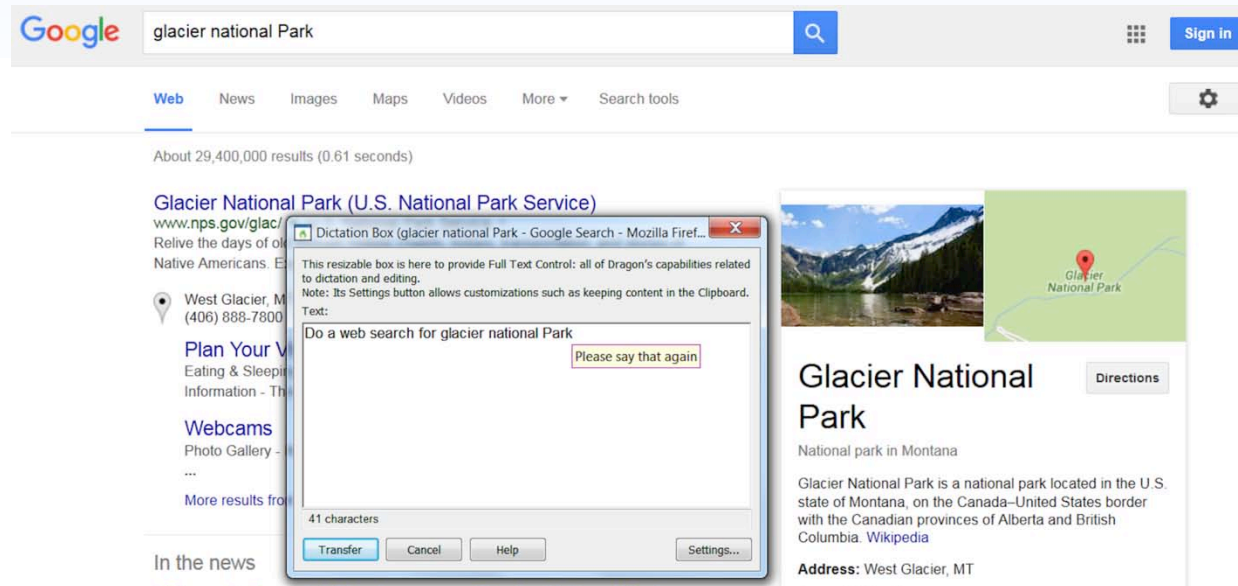
- Mobile devices assistants (from left to right: Siri, GoogleNow, Cortana and Hound) all have similar microphone buttons, but different ways of presenting suggestions

Designing spoken interaction (continued)




- Correcting a word during dictation using Nuance Dragon™.
- After saying “Correct finnish” the word is selected and possible corrections are displayed in a menu, along with additional commands such as “Spell that”
- Users can use the cursor, arrow keys, or voice to specify their choice

Designing spoken interaction (continued)



- It can be difficult to remember what exact command will accomplish the task
- In this example when the user said “Search the web for Glacier National Park” a Google search was launched and a search executed with the correct terms, but when the user said “Do a web search for Glacier National Park” the text was indeed accurately recognized but not as a command, so the text was placed in the Nuance Dragon™ dictation box



Designing spoken interaction (concluded)

```
give me help
give me help on commands
[ ( go | move ) ] ( ( ( back | backward | backwards ) | ( forward | forwards ) ) | ( up | down ) ) ( one | a ) line
[ ( go | move ) ] ( ( ( back | backward | backwards ) | ( forward | forwards ) ) | ( up | down ) ) ( twenty | ... ) lines
( go | move ) ... [ ( ( one | one ) | ( twenty | ... ) ) ]
[ ( go | move ) ] ( ( left | right ) | ( ( back | backward | backwards ) | ( forward | forwards ) ) ) ( one | a ) character
[ ( go | move ) ] ( ( left | right ) | ( ( back | backward | backwards ) | ( forward | forwards ) ) ) ( twenty | ... ) characters
( go | move ) to [ the ] ( bottom | end )
( go | move ) to [ the ] ( bottom | end ) of [ the ] ( line | document )
( go | move ) to [ the ] ( start | top | beginning )
( go | move ) to [ the ] ( start | top | beginning ) of [ the ] ( line | document )
go to sleep
go_to_sleep
help me
```

- A small subset of the rich set of commands used in the Nuance Dragon™ speech recognition system
- Synonyms are included and used consistently

Speech Production

- Speech production is usually successful when the messages are simple and short; and users' visual channels are overloaded
- There are three general methods to produce speech:
 1. Formant synthesis – machine-generated speech using algorithms
 2. Concatenated synthesis – uses tiny, recorded human speech segments
 3. Canned speech – fixed, digitized speech segments

Speech Production (continued)

- Examples:
 - Audio books or audio tours
 - Instructional systems
 - Online help systems
 - Alerts and warnings
 - Applications for the visually impaired

Human Language Technology

- Machines that understand natural language
- Natural language interaction (NLI)
 - Series of exchanges or “dialog” is difficult to design and build, on even a single topic
 - Current successes often rely on statistical methods based on the analysis of vast textual or spoken data from millions of users
- Example applications and methods include:
 - Question answering strategies
 - Extraction and tagging, e.g. gathering data from a database of medical records
 - Human language text generation
 - Instructional systems
 - Language translators, e.g. Google Translate

Human Language Technology (continued)



- Using the Immersive Naval Officer Training System (INOTS) new navy officers can practice their counseling skills in a virtual reality environment
- Officers listen to an avatar and respond using spoken language, loosely following suggestions from multi-choice prompts presented on the screen and designed to match the learning objectives
- The interaction is constrained but assessment is facilitated
(Dyke, 2013; www.netc.navy.mil/nstc/news_page_2012_02_24_2.asp)

Human Language Technology (concluded)

The screenshot shows the Google Translate web interface. At the top, the Google logo is on the left, and the user's name 'Catherine' with a profile picture and a notification icon is on the right. Below the logo, the word 'Translate' is displayed in red. The main interface has two input boxes. The left box contains the French text 'Dur de traduire ces drôles de phrases' with 'ces drôles de' highlighted in blue. The right box contains the English translation 'Hard to translate these funny sentences' with 'these funny' highlighted in blue. A dropdown menu is open over the English text, showing suggestions: 'these funny', 'these strange', 'those funny', 'those strange', 'those weird', and 'Improve this translation'. Below the input boxes, there are sections for 'Definitions of drôle' and 'Translations of drôle'. The 'Definitions of drôle' section includes the word 'drôles' with a speaker icon, the word 'drôle' with its definitions as an adjective (Amusant, comique and Bizarre), and a 'See also' section with the phrase 'histoire drôle, C'est drôle'. The 'Translations of drôle' section lists various adjectives and their corresponding French translations: funny (drôle, amusant, marrant, bizarre, comique, étrange), amusing (amusant, drôle, plaisant), comical (comique, cocasse, drôle, bouffon, risible), comic (comique, drôle, bouffon, cocasse, risible), droll (drôle, comique, bizarre), and rum (drôle, bizarre, étrange, biscornu). At the bottom, there are links for 'Turn off instant translation', 'About Google Translate', 'Mobile', 'Community', 'Privacy & Terms', 'Help', and 'Send feedback'.

Google Translate interface showing a French sentence being translated into English.

French input: Dur de traduire ces drôles de phrases

English output: Hard to translate these funny sentences

Definitions of drôle:

- adjective
- Amusant, comique.
- "Ce comédien est très drôle ."
- Bizarre.
- "C'est drôle, on n'a pas entendu parler de lui depuis longtemps ."

Translations of drôle:

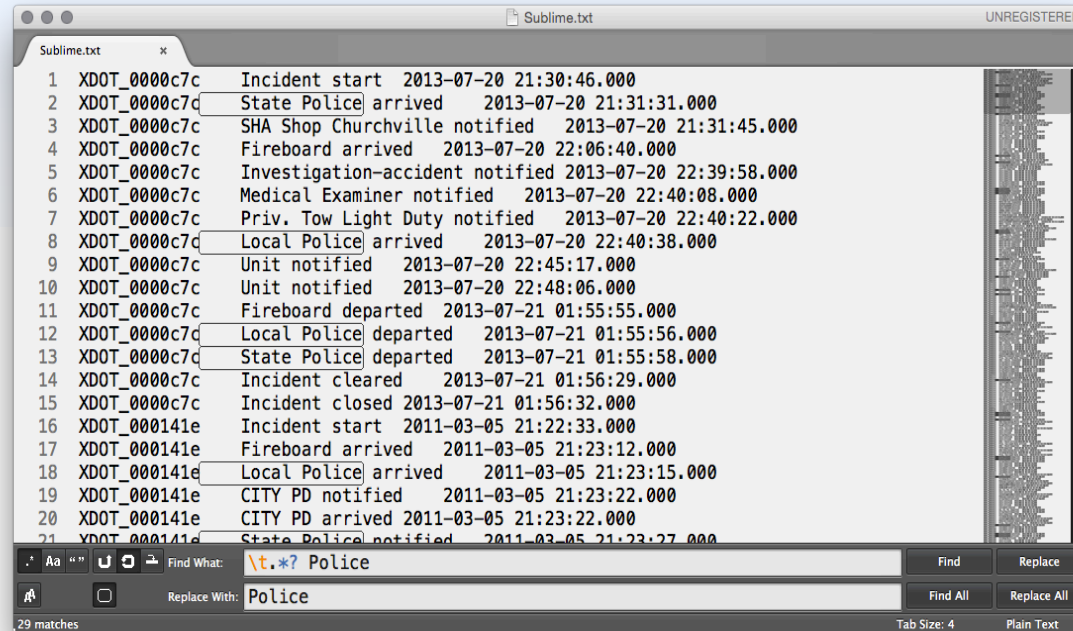
- adjective
- funny: drôle, amusant, marrant, bizarre, comique, étrange
- amusing: amusant, drôle, plaisant
- comical: comique, cocasse, drôle, bouffon, risible
- comic: comique, drôle, bouffon, cocasse, risible
- droll: drôle, comique, bizarre
- rum: drôle, bizarre, étrange, biscornu

- Google Translate, showing a French sentence translated in English

Command Languages

- Command languages are often preferred by expert users who do not want to drag and drop items for repeated steps.
- A command language example is the Unix command used to delete blank lines from a file
 - `grep -v ^$ filea > fileb`
- Casual users favor GUIs but both styles of interface can be made available successfully
- Other examples that behave like command languages:
 - Web addresses (URLs) can be seen as a form of command language
 - Twitter addresses
 - Database query languages

Command Languages (concluded)



- Using the Sublime text editor a user is doing a search and replace in a data table using regular expressions
 - Typing “\t.*? Police” in the search box searches for a tab followed by zero or more character, a space, and then by “Police”
 - The patterns found in the document are highlighted with a thin black line in the document, showing that both “local police” and “state police” have been found and selected
 - An overview of the entire document is visible on the right, revealing the presence of many other matches that can now be replaced all at once.