When Natural Language Isn't: The Need For a Dedicated Speech Interface

Kimberly Patch
August 8, 2006
Optimistic Headlines from the 90’s

THE MACHINES ARE LISTENING
Computers can't take dictation, but they may already understand speech well enough to take your job
- Time, August 10, 1992

LET'S TALK!
Speech technology is the next big thing in computing. Will it put a PC in every home?
- Business Week, February 23, 1998
The wrong tool for the job
Communication Skills Comparison

Humans recognize words
Computers recognize words
Communication Skills Comparison

Humans recognize words
Computers recognize words

Humans understand word meanings
Computers do not
Communication Skills Comparison

Humans recognize words
Computers recognize words

Humans understand word meanings
Computers do not

Humans are adept at adapting language on-the-fly
Computers are not
Two Fry
Communication Skills Comparison

Star Trek’s ship computer and 2001’s Hal understand word meanings and adapt.

Today’s desktop computers do not.
Fake It

Use synonymous commands -- pseudo-natural language -- to make it seem like the computer understands and adapts
NaturallySpeaking commands to move the cursor to the beginning of the line
Pseudo-natural-language Drawbacks

1. Even long lists of synonymous commands are **not exhaustive**
Pseudo-natural-language Drawbacks

1. Even long lists of synonymous commands are not exhaustive

2. Synonymous commands don’t build habits
Pseudo-natural-language Drawbacks

1. Even long lists of synonymous commands are not exhaustive
2. Synonymous commands don’t build habits
3. Synonymous commands don’t combine well
If the human doesn't have to think between steps, there's no need for separate steps.
If the human doesn't have to think between steps, there's no need for separate steps.
Speech Interface Challenges

• How do you remember commands?
Speech Interface Challenges

• How do you remember commands?

• How do you combine commands without running into an exponential problem?
The Exponential Explosion

20 commands, 10 wordings each, 4-command combinations
20 x 10 = 200 single commands
200 x 199 x 198 x 197 = 1,552,438,800 combinations

vs.

20 commands, 1 wording each, 4-command combinations
20 x 19 x 18 x 17 = 116,280 combinations
The Solution: a Structured Grammar

Tap the human’s natural ability to adapt
Carnegie Mellon Study

74% of users prefer a structured rather than natural language approach to speech recognition

Important Factors

• How the brain processes words
Important Factors

• How the brain processes words

• Memory chunking
Important Factors

• How the brain processes words
• Memory chunking
• Six degrees of separation
Human-Machine Grammar

• No synonyms
Human-Machine Grammar

- No synonyms
- Logical rules to minimize wording possibilities
Human-Machine Grammar

• No synonyms

• Logical rules to minimize wording possibilities

• Follows the way the human brain uses language
<table>
<thead>
<tr>
<th>Asking Computer</th>
<th>Commanding Objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Close Window</td>
<td>Window Close</td>
</tr>
<tr>
<td>Select Next 3 Lines</td>
<td>3 Lines</td>
</tr>
</tbody>
</table>
Structured Grammar’s Advantages

• Set commands are unambiguous
Structured Grammar’s Advantages

• Set commands are **unambiguous**

• Set commands **build habits**
Structured Grammar’s Advantages

• Set commands are unambiguous
• Set commands build habits
• Small vocabulary enables combined commands
How do you remember commands?

Use a structured grammar that follows the way the brain works.
## Editing

<table>
<thead>
<tr>
<th>Task</th>
<th>Keyboard</th>
<th>Mouse/Keyboard</th>
<th>Naturally Speaking</th>
<th>Utter Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut next two paragraphs</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Delete last four words</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Bold one word before and two words after cursor</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>
## Moving the Mouse Arrow

<table>
<thead>
<tr>
<th>Task</th>
<th>Keyboard</th>
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<th>Naturally Speaking</th>
<th>Utter Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place and click mouse arrow</td>
<td>NA</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Drag object</td>
<td>NA</td>
<td>3</td>
<td>9</td>
<td>2</td>
</tr>
</tbody>
</table>
### Opening Folders and Files

<table>
<thead>
<tr>
<th>Task</th>
<th>Keyboard</th>
<th>Mouse/Keyboard</th>
<th>Naturally Speaking</th>
<th>Utter Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Word and navigate to the <strong>folder</strong> My documents\budgets\August 2006</td>
<td>8*</td>
<td>4*</td>
<td>7*</td>
<td>2</td>
</tr>
<tr>
<td>Open the <strong>file</strong> C:\Program Files\Redstart Systems\UC\UC Demo\Demo 1.doc</td>
<td>15</td>
<td>9</td>
<td>19</td>
<td>1</td>
</tr>
</tbody>
</table>

*Assumes that the Word Open dialog box opens to “My documents” folder*
## Preparing Email, Accessing the Web

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<th>Naturally Speaking</th>
<th>Utter Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare email message</td>
<td>12</td>
<td>5</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Open browser to NewYorkTimes.com</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>
Classic Computer Interface Challenges

1. Easy folder and file access
2. Command consistency across programs
3. Keeping command steps to a minimum
4. Fluid switching among programs
A Structured Grammar

- Makes commands easy to remember and use
- Enables combined commands

It’s the right tool for the human-machine interface
Human-Machine Grammar – the 16 grammar rules and dictionary of command words

Papers – talks that detail the thinking behind Human-Machine Grammar

Utter Command – speech interface software based on Human-Machine Grammar
Empowering Your customers and employees with speech technologies

SpeechTEK 2006 Empower
The Voice Solutions Showcase

Thank You