

Towards a Natural User Interface

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Talk Outline

- The NUI revolution
 - The vision.
 - The ingredients and technologies.
- 5 challenges to getting NUI started
- 10 steps to overcome challenges
- Conclusion

User Interface Evolution

**Graphical
User Interface**

**Search Engines
Hyperlinks**

**Multiple Windows
Menus**

Command line

**1985
PC**

**1990
GUI**

**1995
Internet**



User Interface Evolution

Graphical User Interface

GUI Technology

Direct manipulation

- Mouse / keyboard input
- Mouse input mapped to Windows, menus, etc.
- Keyboard input (search) mapped to text index

Enables

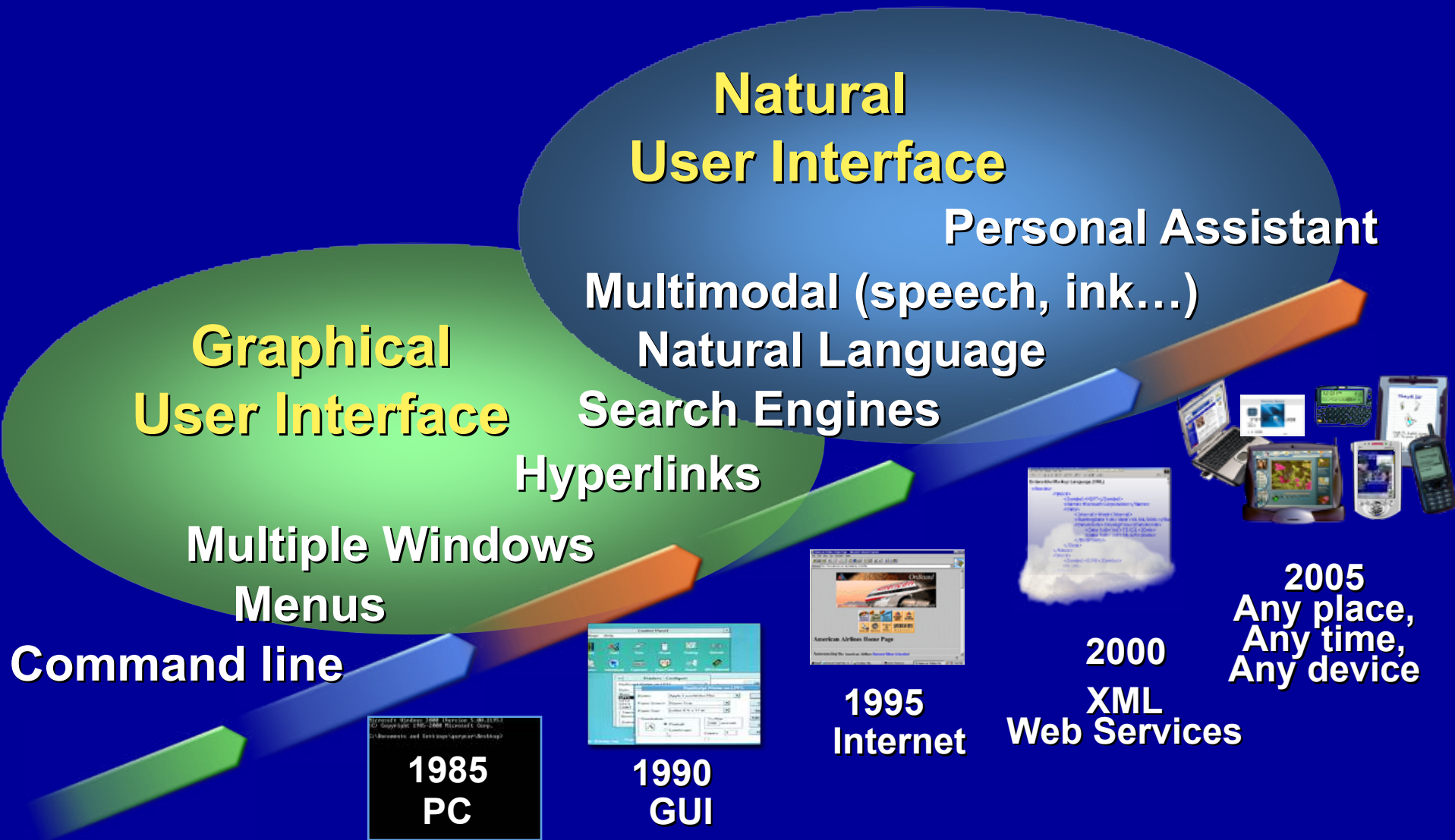


GUI Interaction

User is the expert and knows

- What functions exist
- Where to go
- What to click (and in what order)
- What to type

User Interface Evolution



NUI – “Do What I Mean” UI

- Users naturally articulate what they mean, on any device, to any application or web service, and have their intention interpreted and executed accurately.
- Why NUI?
 - Expressive.
 - Natural.
 - Scalable.

Natural User Interface

Motivated by human-human interaction

Interacting with a Librarian



“Information about Chicago”

“Chicago the city, college or music group?”

“City”

“History or travel information?”

“Travel”

“Who knows about traveling to Chicago?”

Books, magazines,
other libraries...

Present choices

Natural User Interface (NUI)

NUI Technology

1. **Hear what you say**
Typed, spoken, written



2. **Know what you mean**
Analyze text
Consider context
Clarify using dialog



3. **Do what you want**
Broker and execute by
finding content / services



Enables

NUI Interaction

User says / types:

*“Information
about Chicago”*

*“I want to travel
to Chicago”*

*“Book my flight to
Chicago using Expedia”*

NUI: Hear What You Say

NUI Technology

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Hear What You Say

- Human language : “Invented” for interaction
 - “[Language is] a biological adaptation to communicate information... One of nature’s engineering marvels”
– *Steven Pinker*
 - “Vision evolved from the need to survive; speech evolved from the need to communicate”
– *Michael Dertouzos.*
- Speech is central...
 - ... but also typing, handwriting, gestures...
 - Best form depends on:
 - Habit / skills (typing to PCs)
 - Form factor (speaking to phones)
 - Situation (writing at meetings)
 - Eventually, multimodal

NUI: Know What You Mean

NUI Technology

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NUI Interaction

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Know What You Mean – *by combining:*

- Syntax (rules of the human's language)
 - Nouns, verbs, etc. and how they combine
 - *“Book about a trip to Chicago” vs. “Book a trip to Chicago”*
 - Normalize linguistic variations .
- Semantics
 - Meaning of the words
 - Book means reserve a ticket; requires from-city, to-city, etc.
- Context (additional hints)
 - Domain knowledge :
 - No train from Hawaii to Chicago
 - Statistics : Book as a noun > Book as a verb
 - *“Book Chicago”*
 - Personal Preferences :
 - *Where you live, your calendar, how you pay...*
 - Model of time, urgency, presence
- Dialog (resolving ambiguity & determine intent)
 - *“Buy a book or book travel?”*
 - *“What date would you like to travel?”*

NUI: Do What You Want

NUI Technology

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Enables

NUI Interaction

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Do What You Want

(by brokering & combining)

- No system can know everything.
- Broker intent to experts:
 - Take user intent and determine
 - “Who are the possible experts for this intent?”
 - Each expert (web service) registers what it knows
 - Encarta knows about history, geography, ...
 - Expedia knows about travel (to various places...)
 - Amazon knows about books, book reviews...
- Combine all experts' answers,
 - Content (like a search) – Find history of Chicago.
 - Action (like a service) – Buy a ticket to Chicago.

NUI Will Enable...

- *Find the Bill Gates book on future*
- *When is the Britney Spears concert?*
- *How do I replace my printer cartridge?*
- *Buy the Gladiator DVD for less than \$15*
- *Send flowers to mom on her birthday*
- *Continue working on my annual report*

Challenges to NUI

- Technology limitations
- User reluctance
- Unproven business value
- High development effort
- More than UI – infrastructure needed

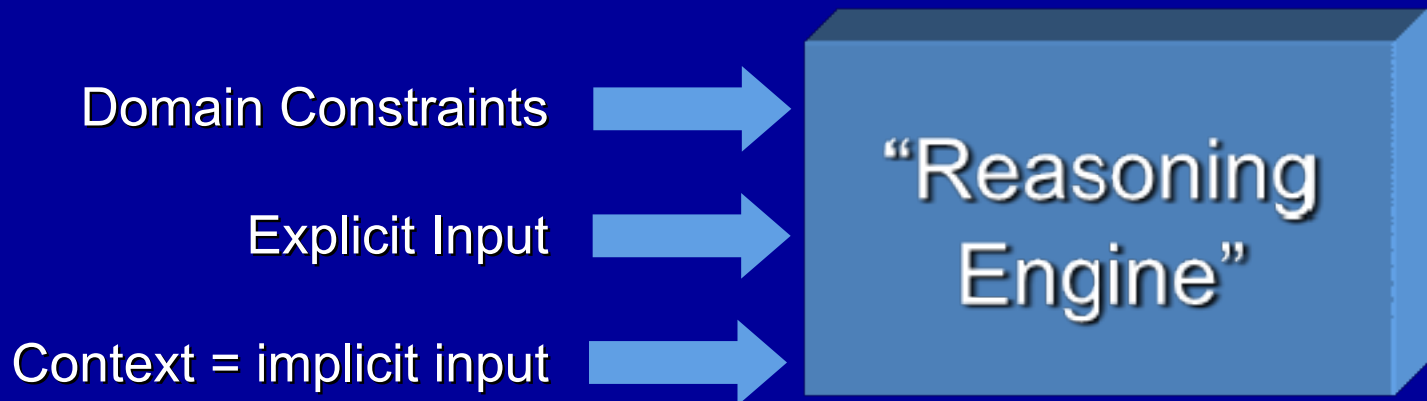
So, how do we make NUI work?
→ 10 evolutionary steps.

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1. Change the world, one domain at a time

- General understanding is hard.
- Domain knowledge can:
 - Reduce linguistic ambiguity: *proceeds, IRA...*
 - Reduce semantic ambiguity: *I want to check in.*
 - Can get benefit even for “very big domains”
- Use of contextual cues helps further.



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